THEORETICAL NAVAL ARCHITECTURE.

THEARLE.

PLATES AND TABLES.

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Putnam's Advanced Science Series.

THEORETICAL NAVAL ARCHITECTURE:

A TREATISE

ON THE

CALCULATIONS INVOLVED IN NAVAL DESIGN.

BY

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1877

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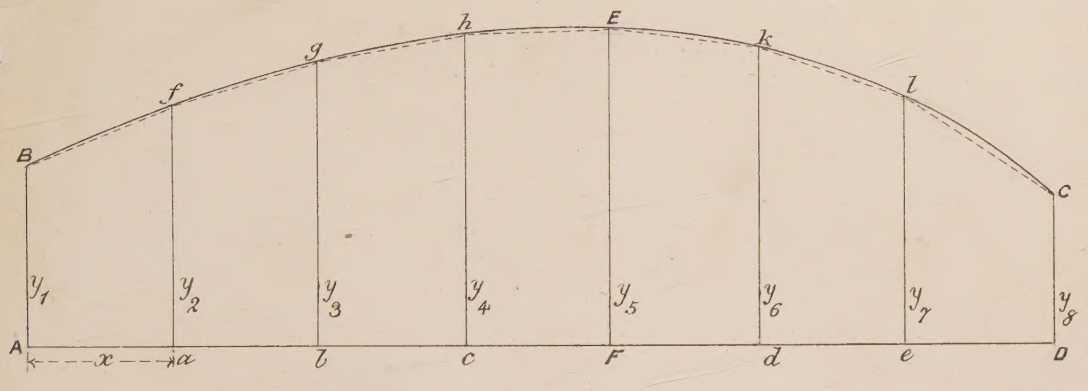
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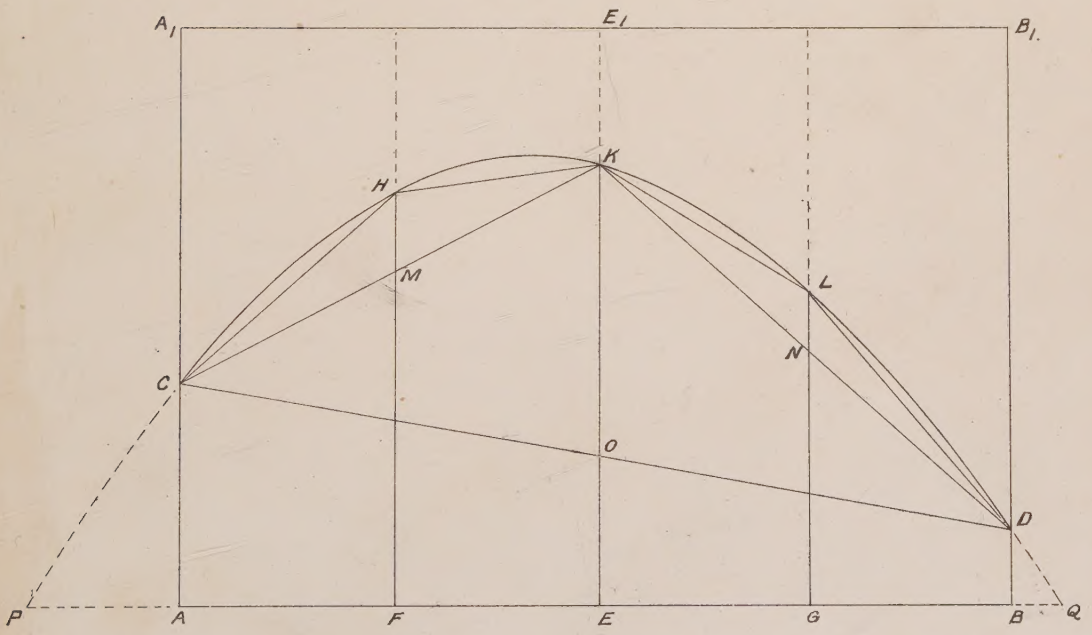
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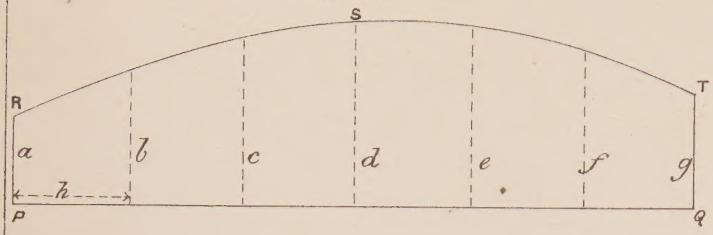

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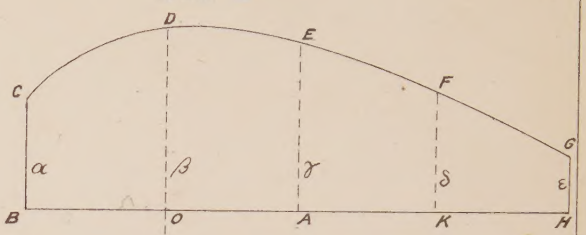

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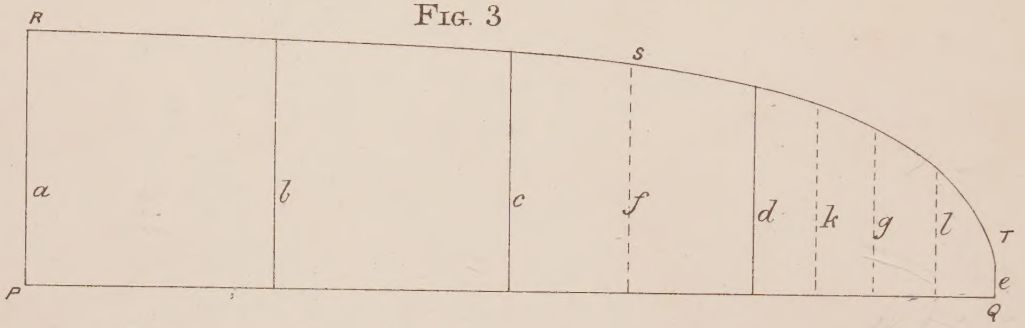

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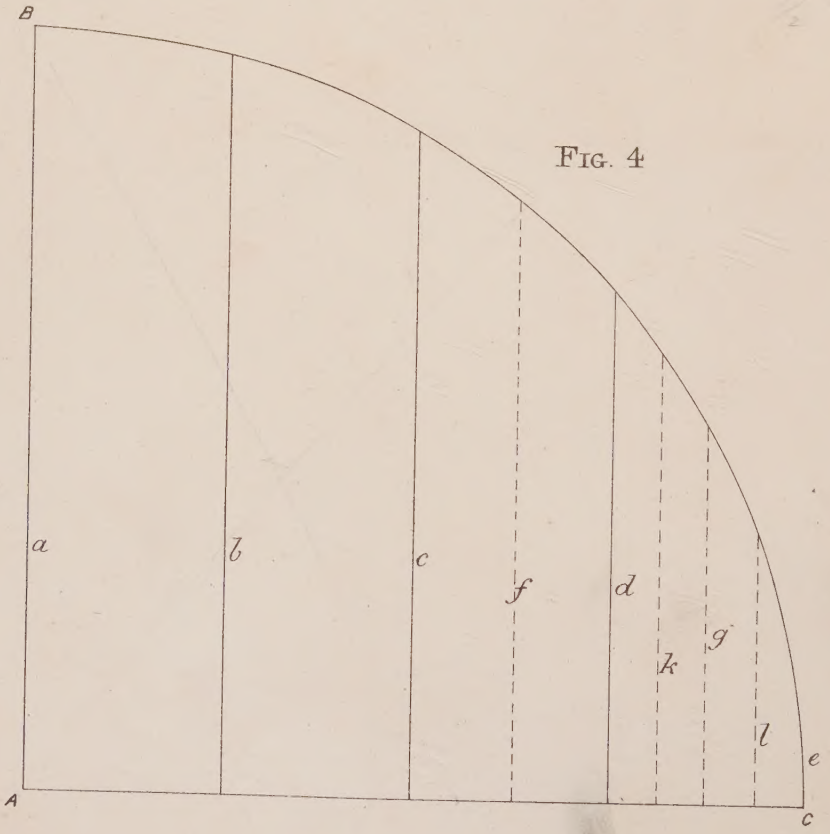

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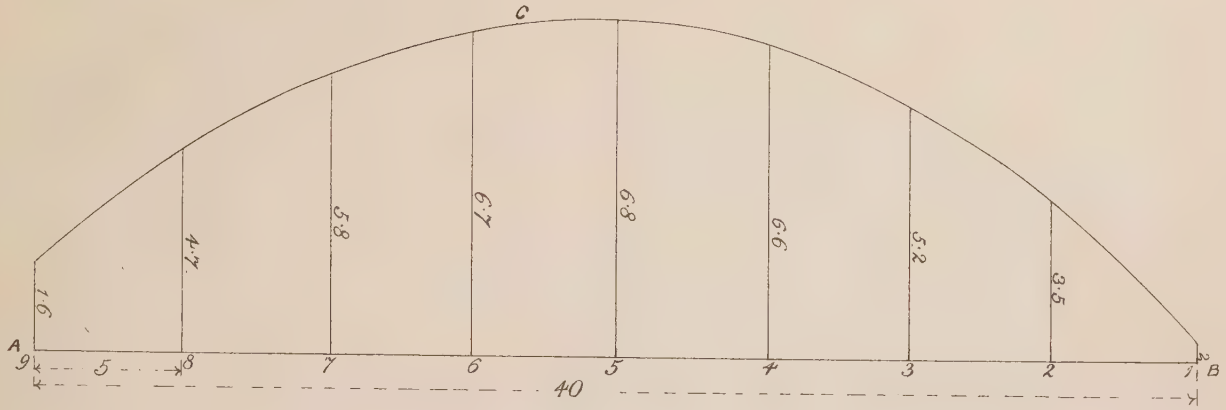

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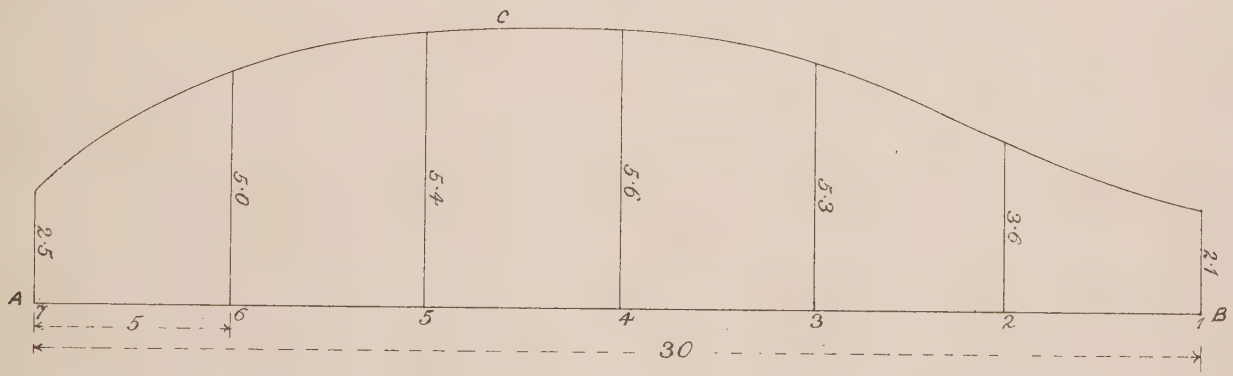

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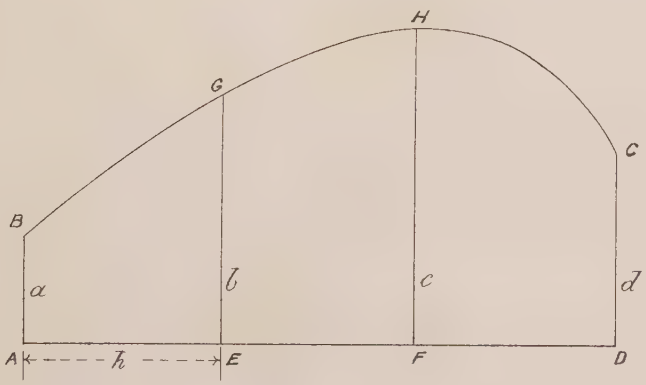

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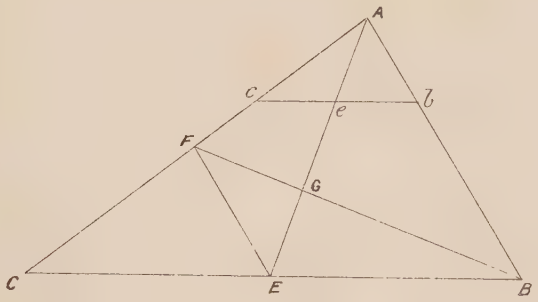

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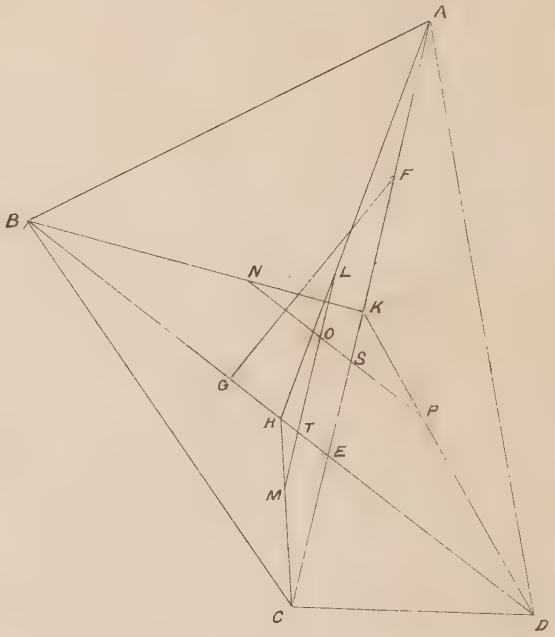

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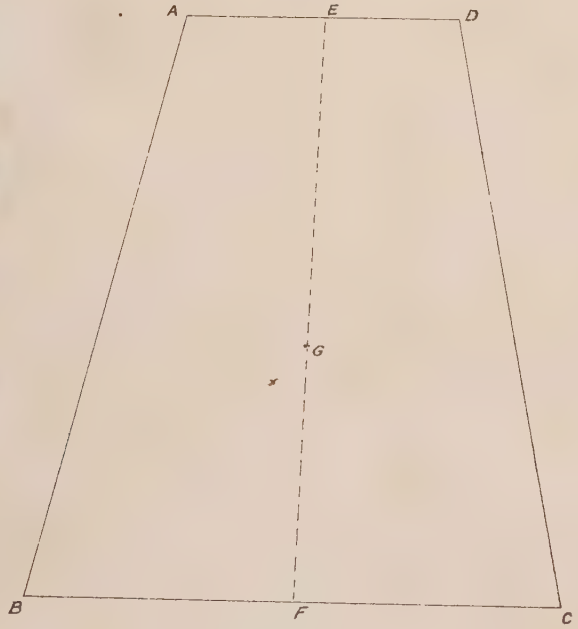

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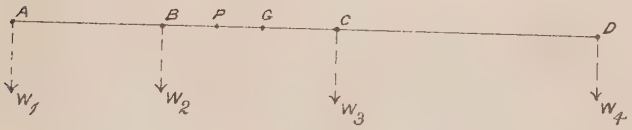

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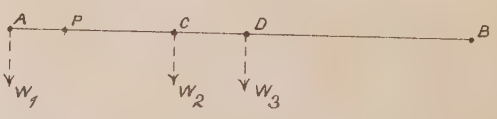

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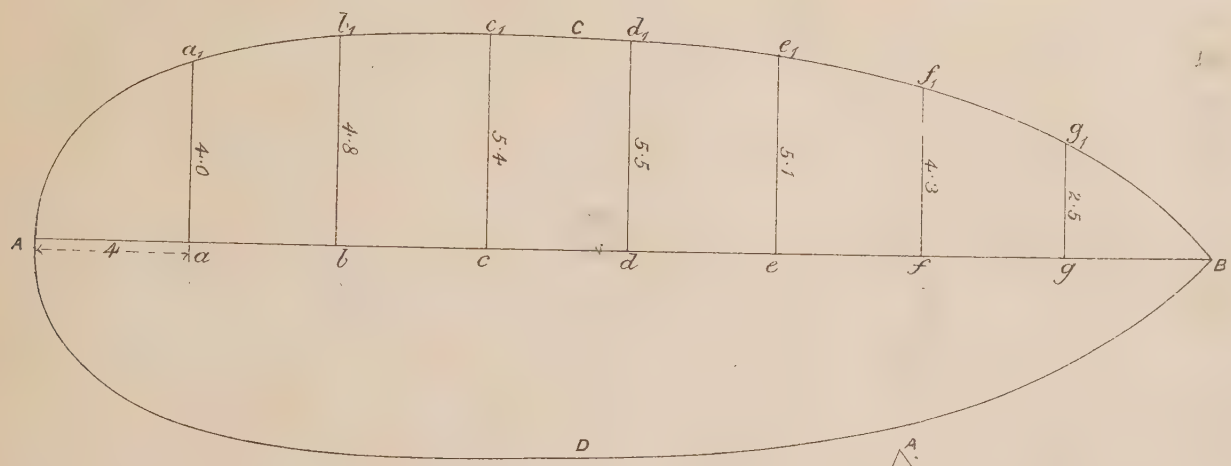

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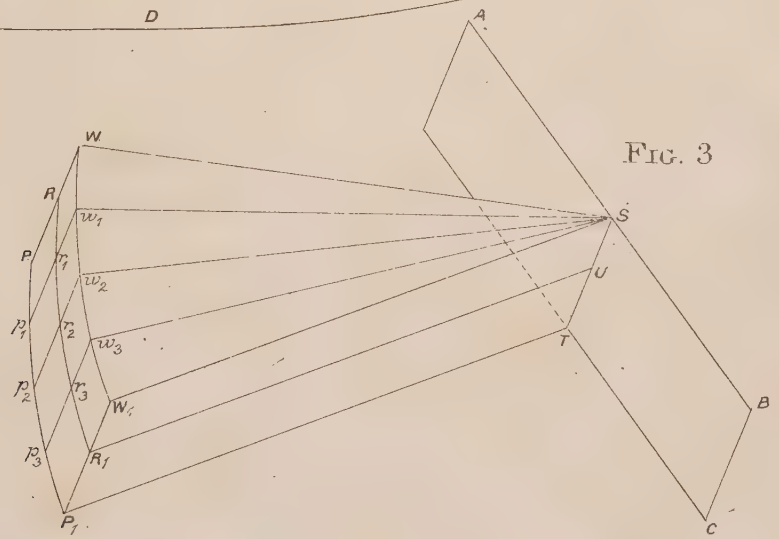

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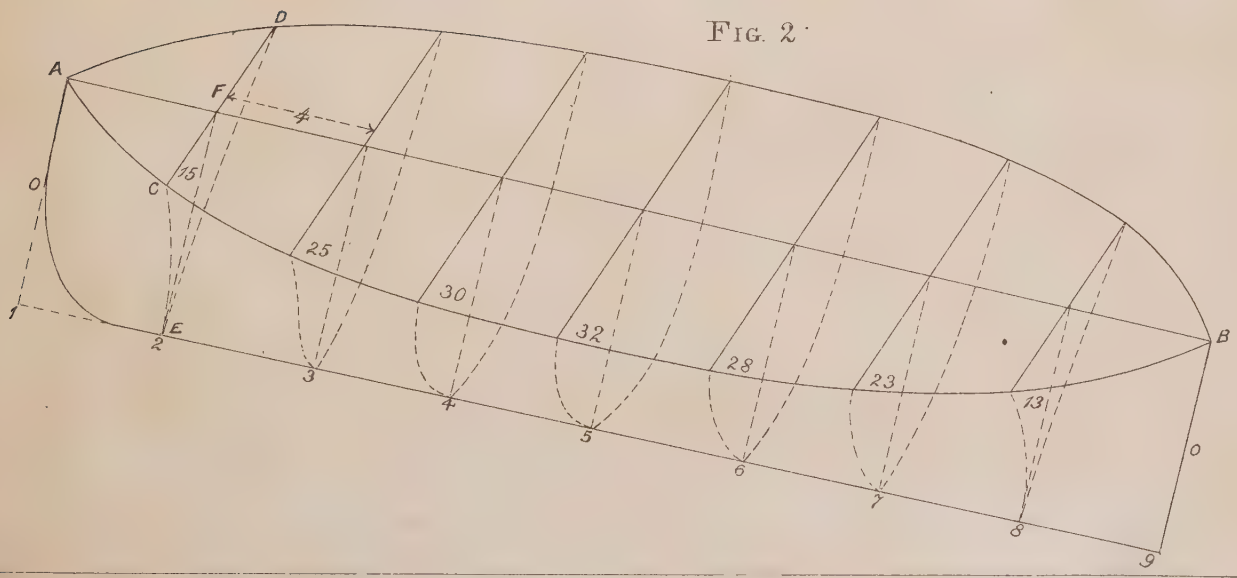


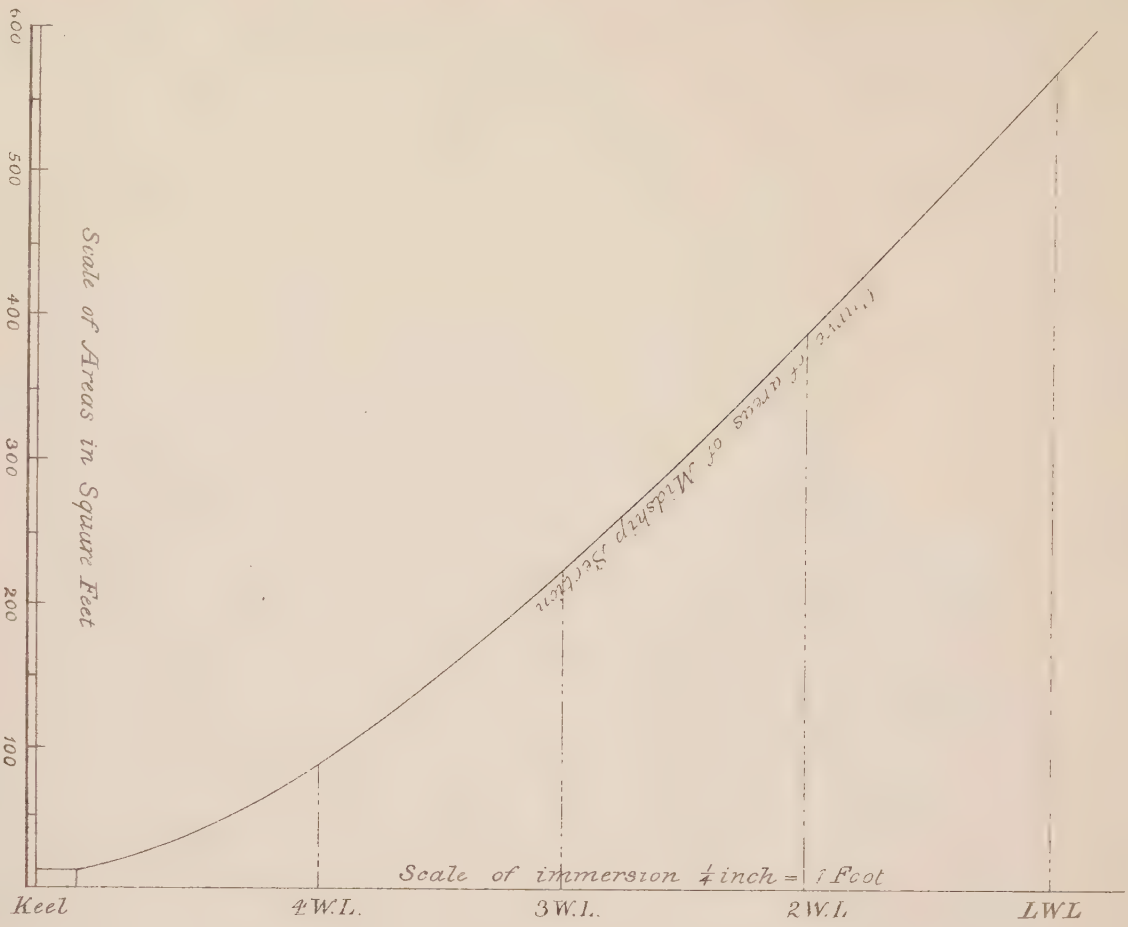
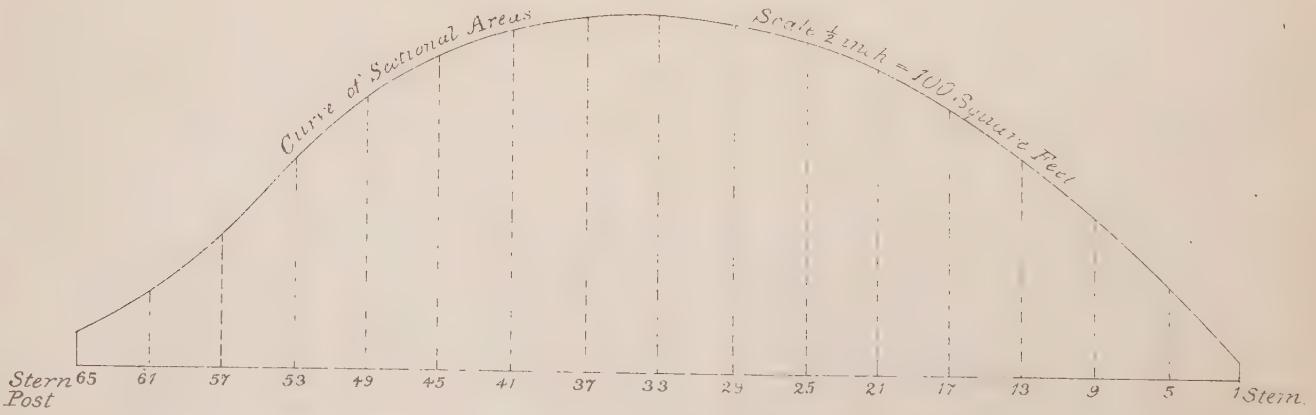

600
500
400
300
200
100
Scale of Areas in Square Feet
Curve of Midship Section
Scale of immersion ¼ inch = 1 Foot
Keel
4 W.L.
3 W.L.
2 W.L.
LWL

FIG. 1

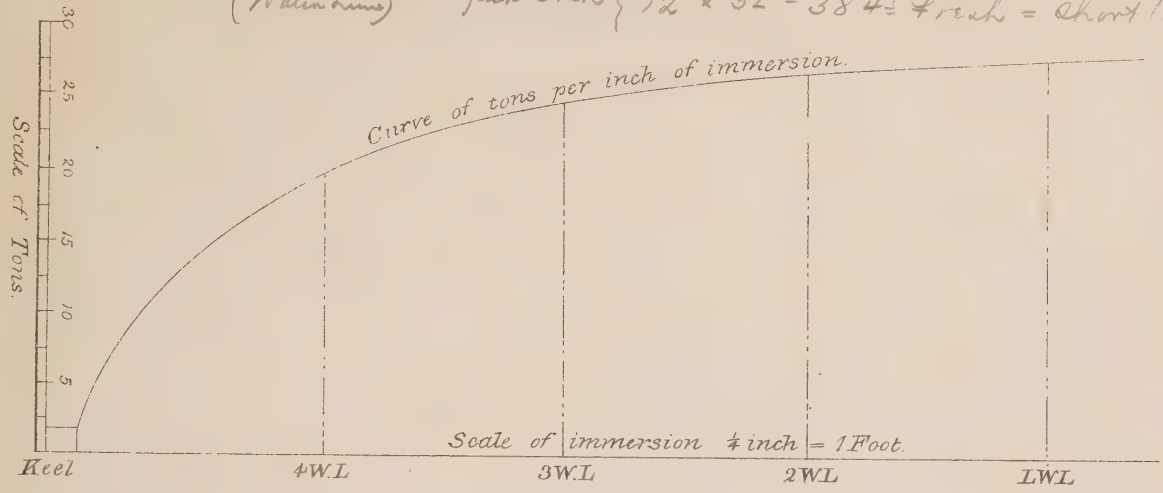
FIG. 2


Curve of Sectional Areas
Scale ½ inch = 100 Square Feet
Stern Post
65
61
57
53
49
45
41
37
33
29
25
21
17
13
9
5
1 Stem.

"C"

area ÷ C = Tons per Inch (Water Line)

12 × 35 = 420 = Salt } Long Ton 2240 lbs
12 × 36 = 432 = Fresh }
12 × 32 = 384 = Fresh = Short Ton 2000 lbs



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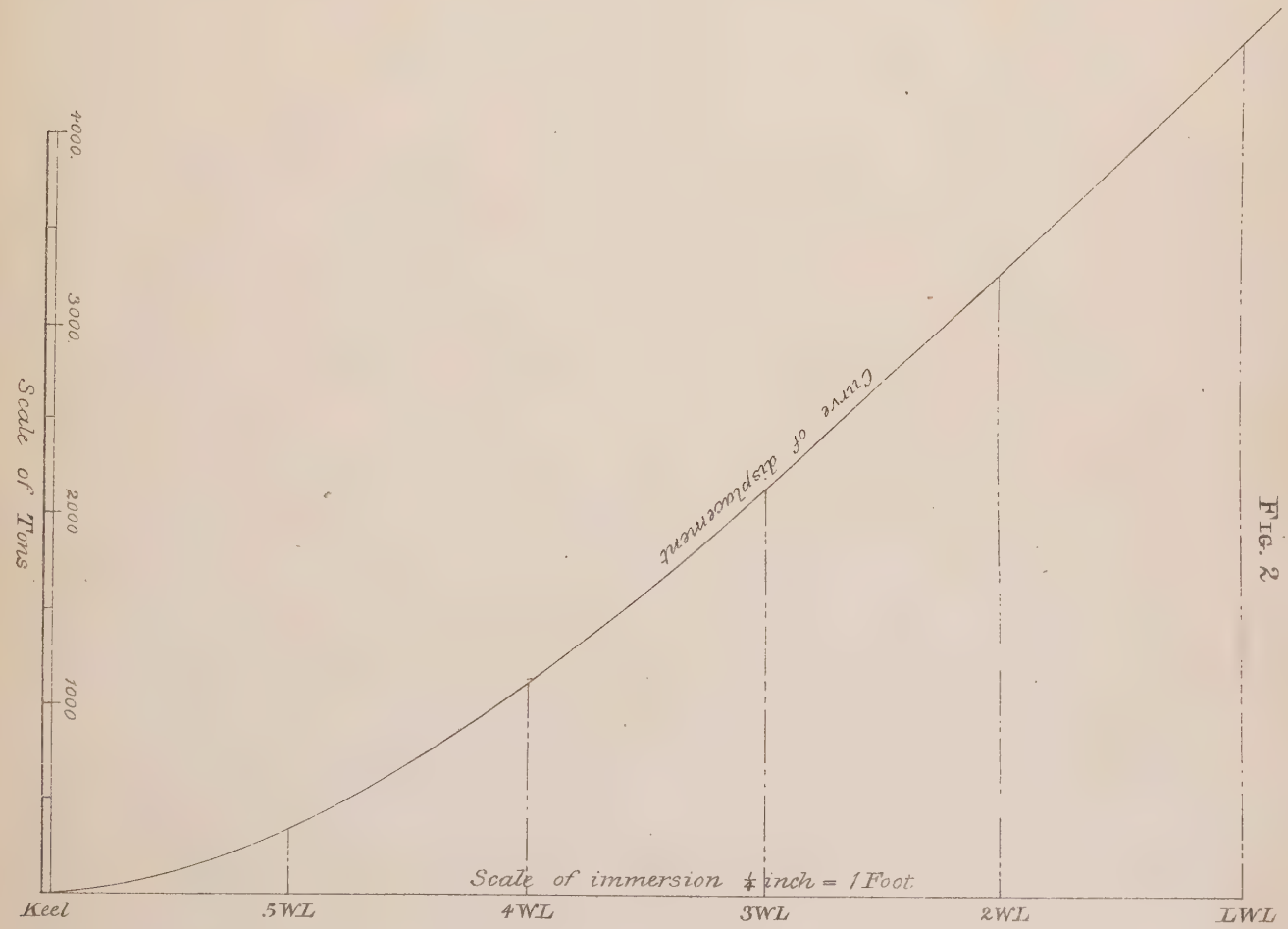

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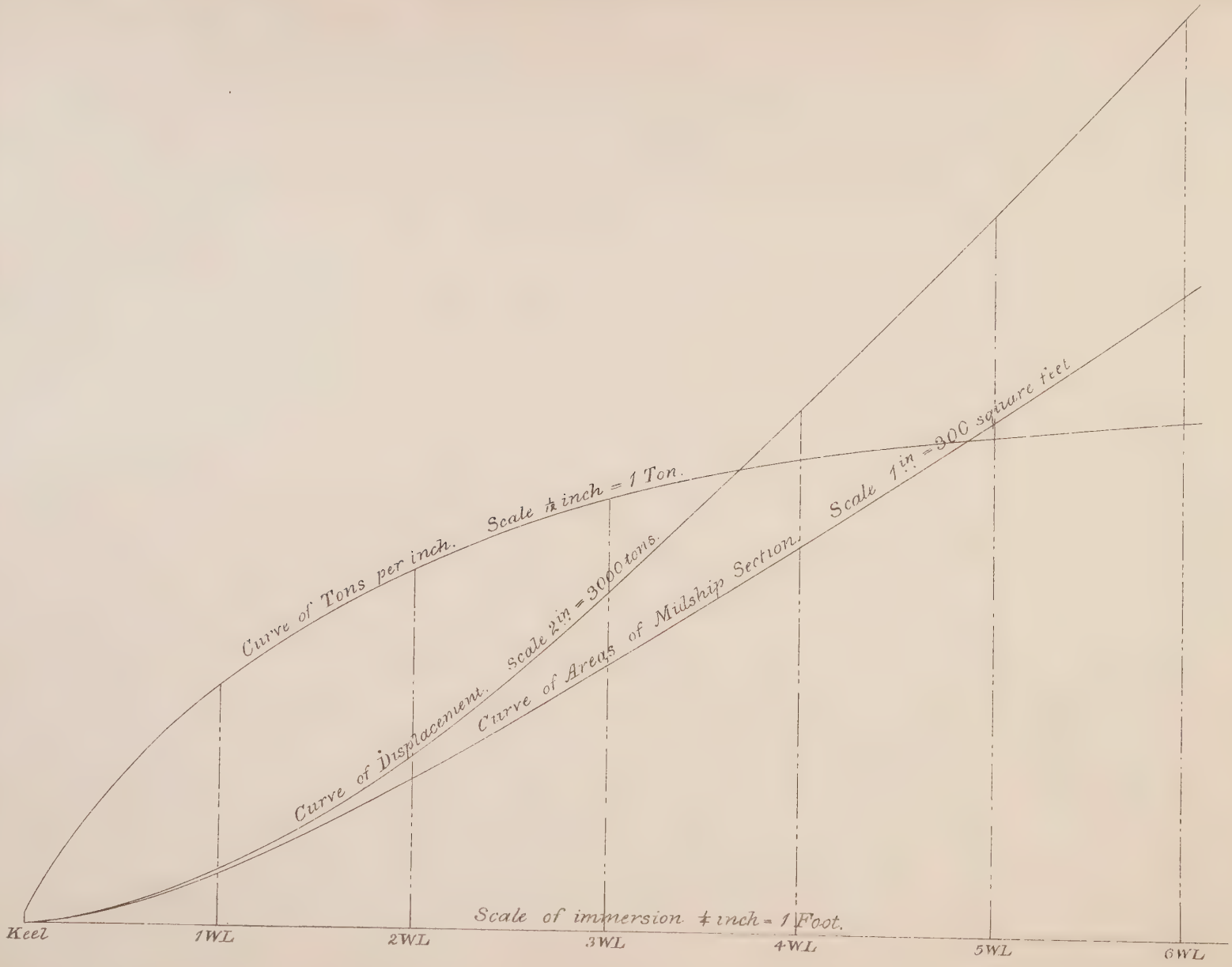
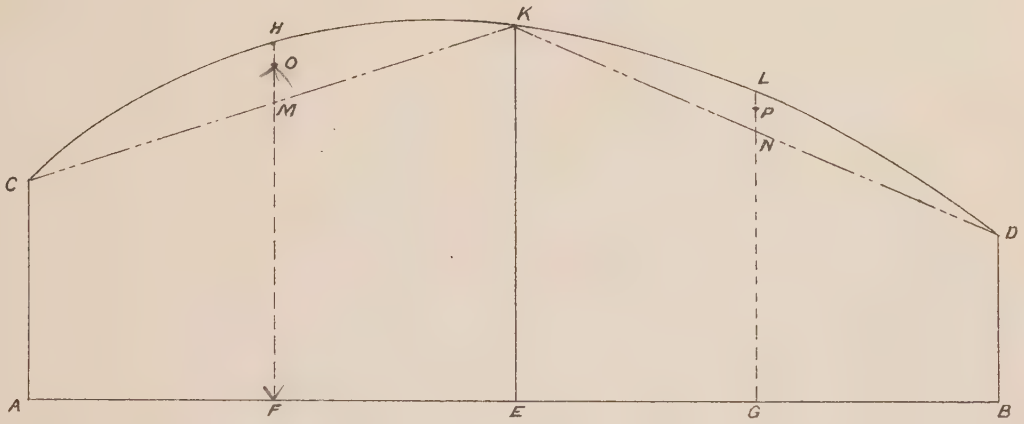

Curve of Tons per inch. Scale ½ inch = 1 Ton.
Curve of Displacement. Scale 2 in = 3000 tons.
Curve of Areas of Midship Section. Scale 1 in = 300 square feet.
Scale of immersion ½ inch = 1 Foot.
Keel
1WL
2WL
3WL
4WL
5WL
6WL

FIG. 1



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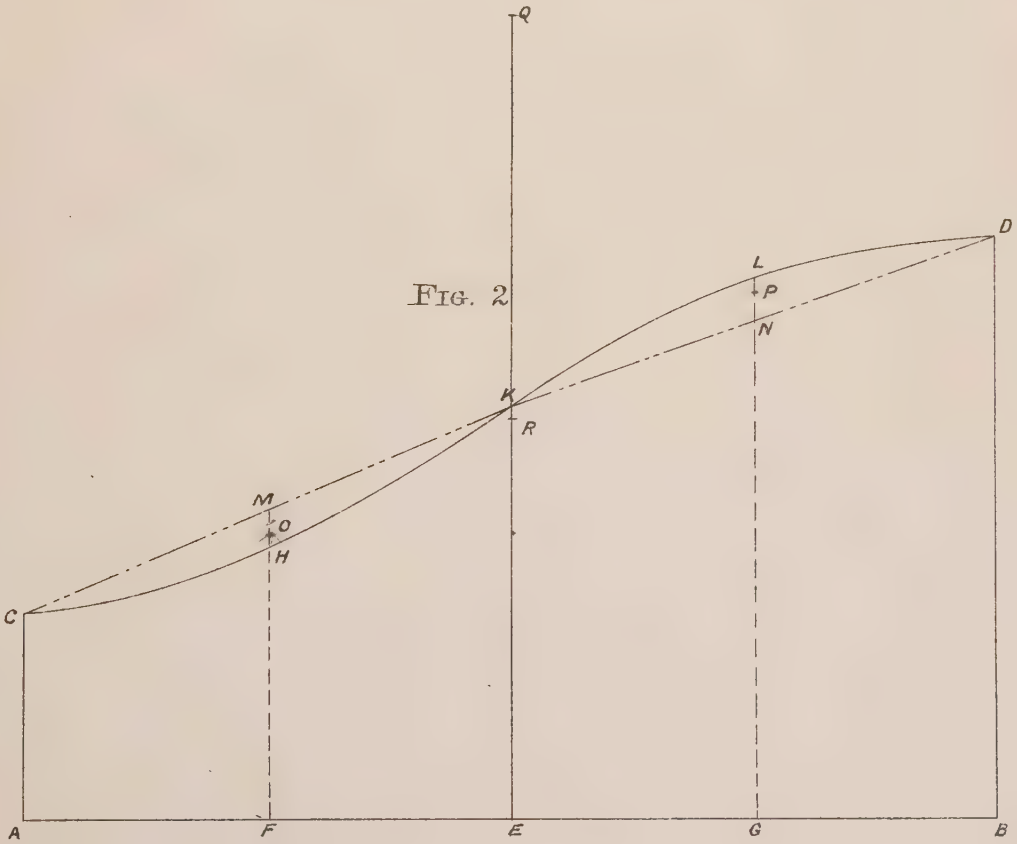
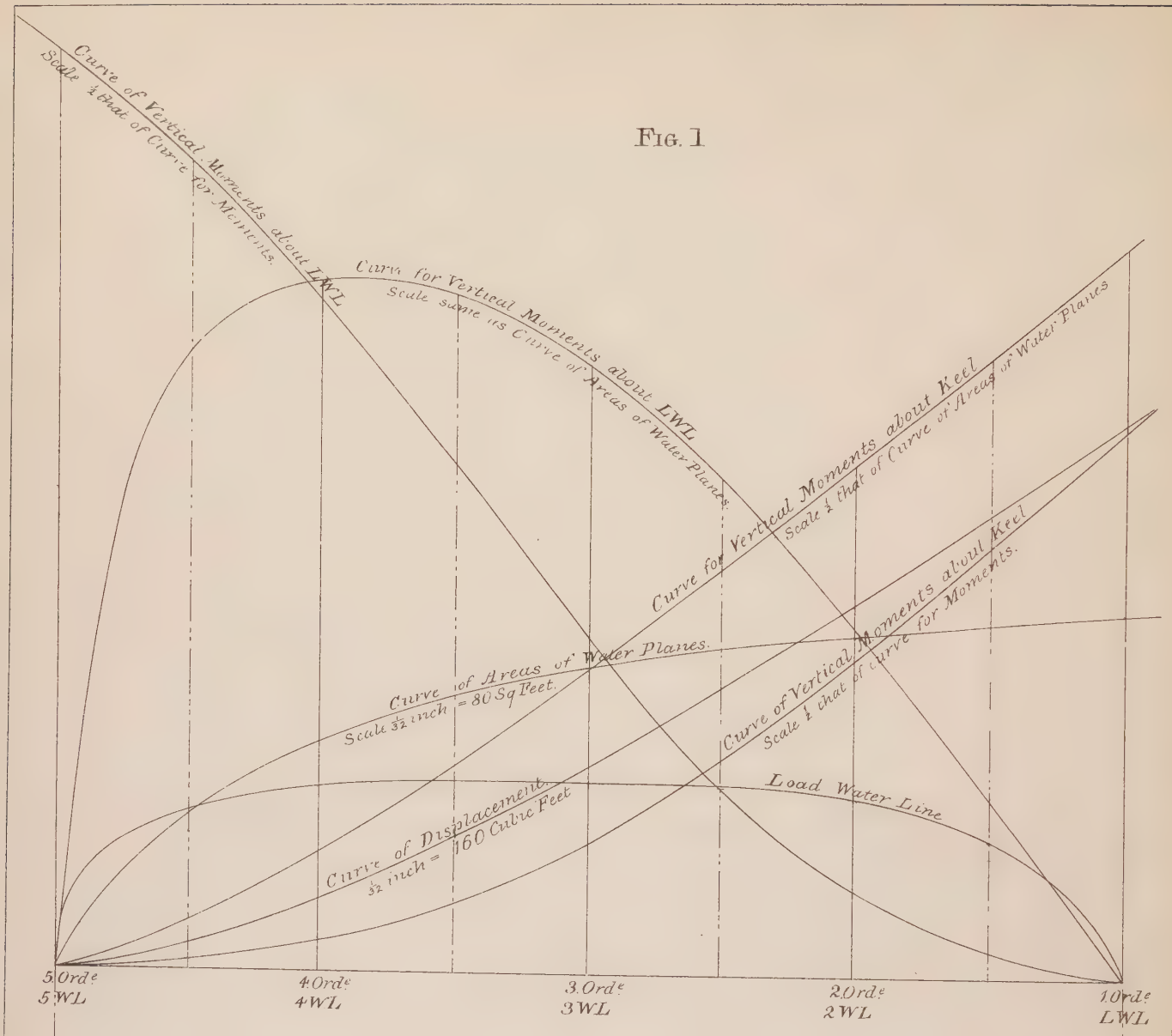


Plate X

Fig. 1



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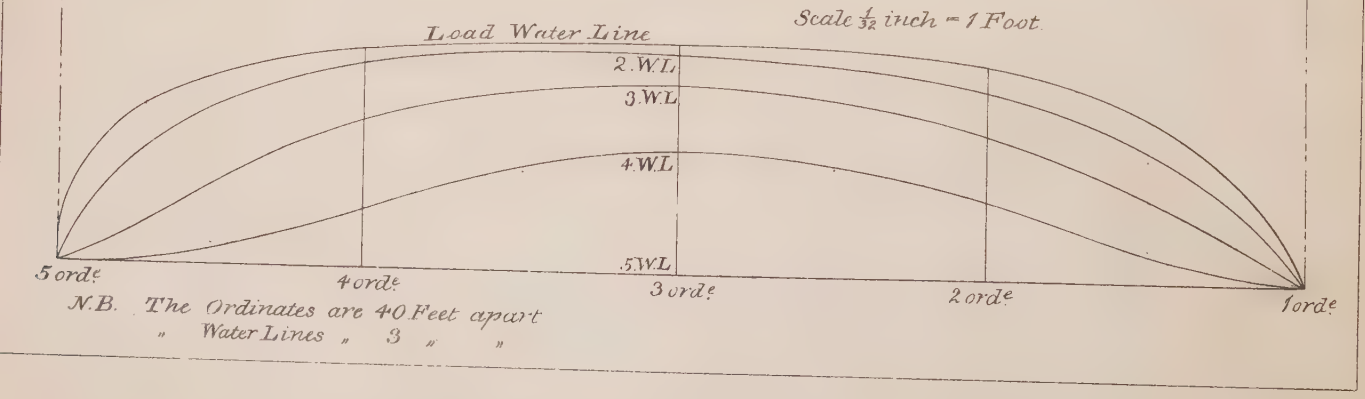
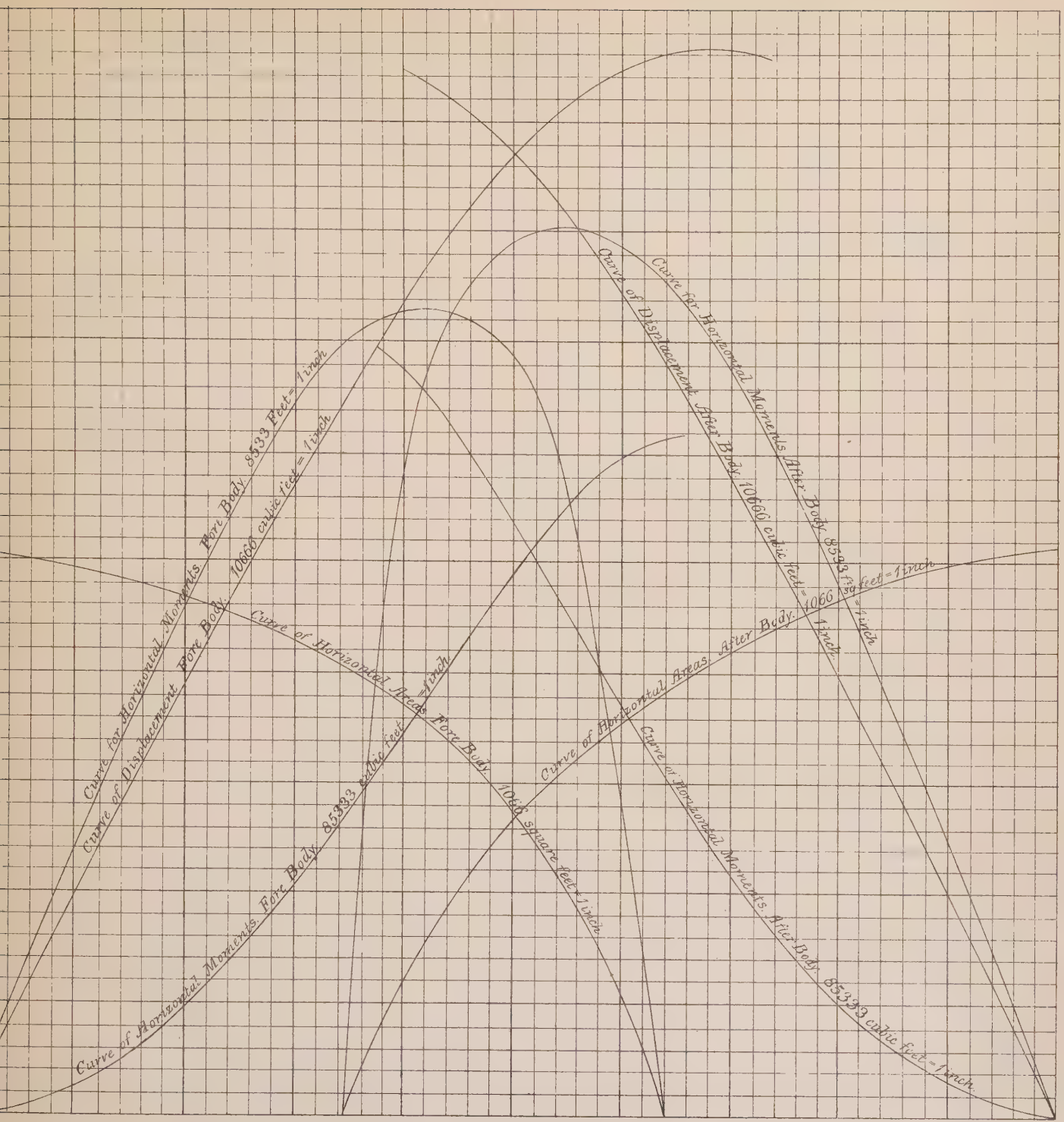


N.B. The Ordinates are 40 Feet apart
" Water Lines " 3 " "



N.B. In the curves of Moments, by a "cubic foot" is meant, a cubic foot of Sea water at a leverage of 1 Foot.

Fig. 1

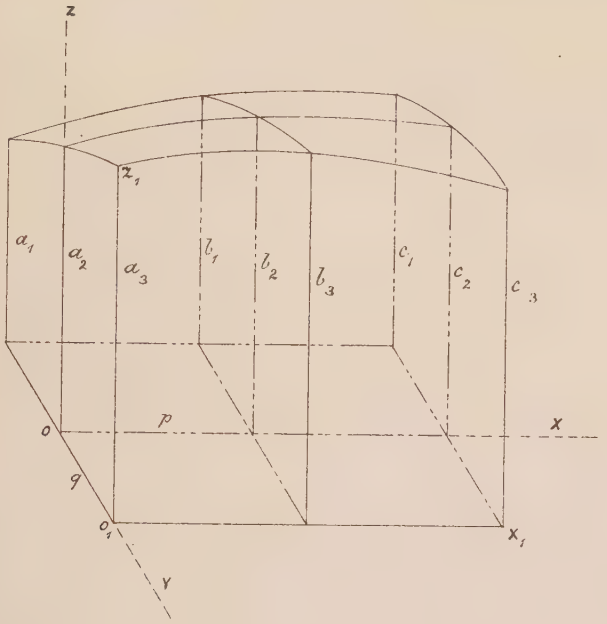
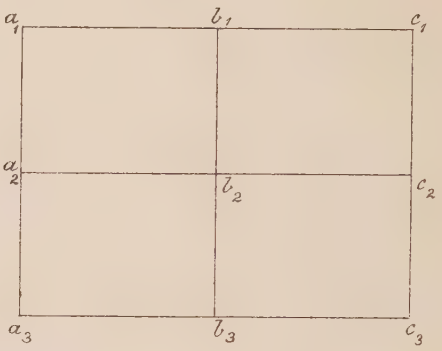


Fig. 2



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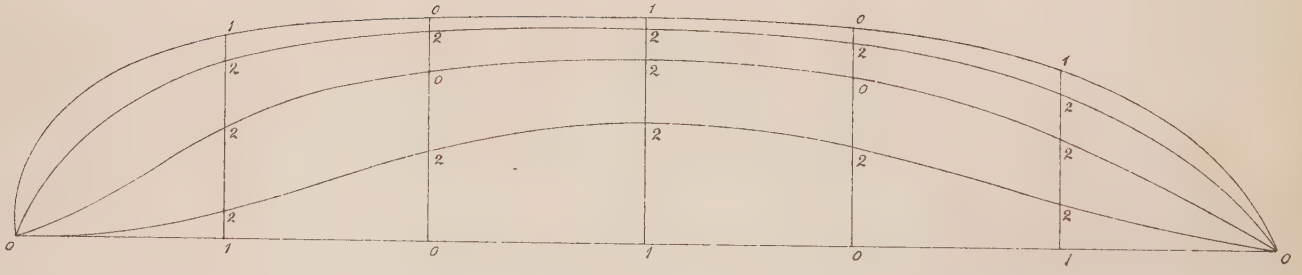

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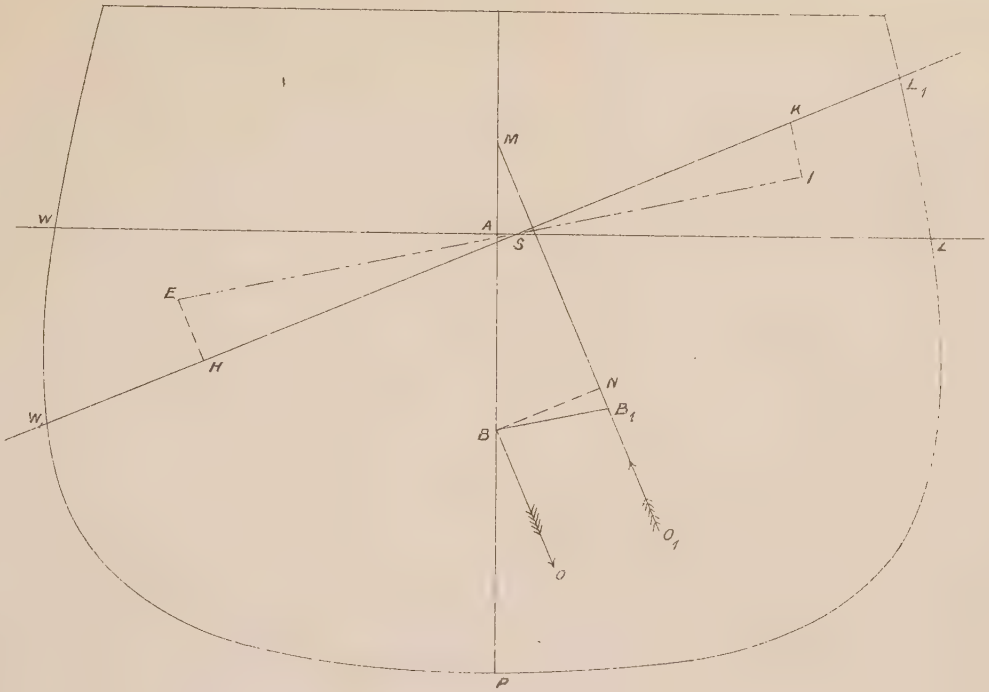

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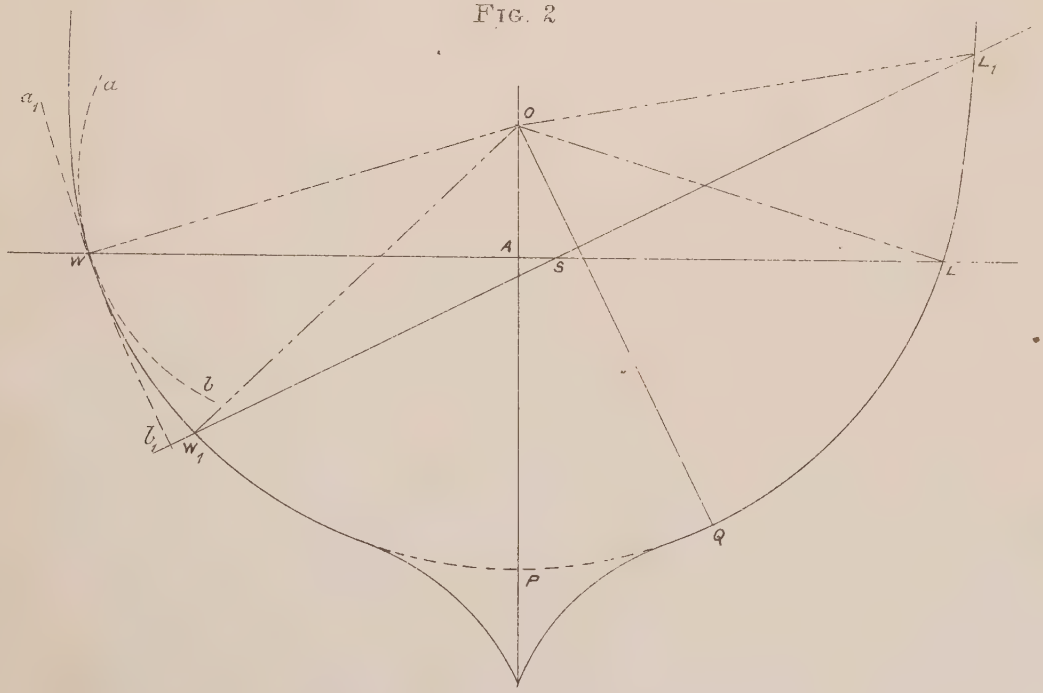

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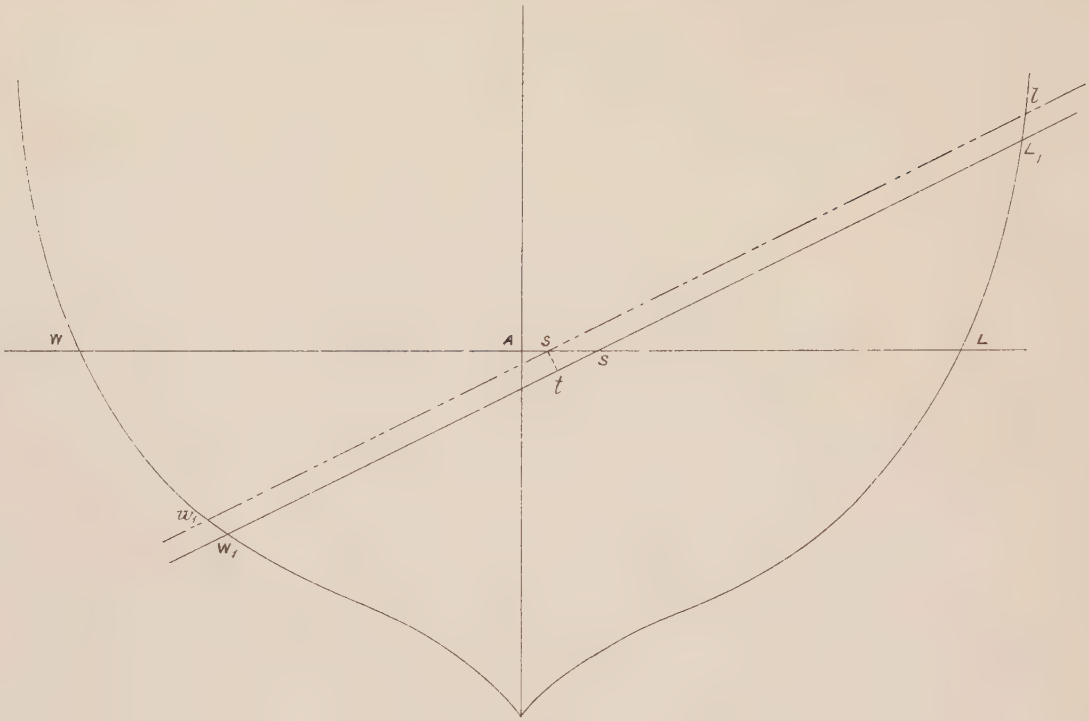

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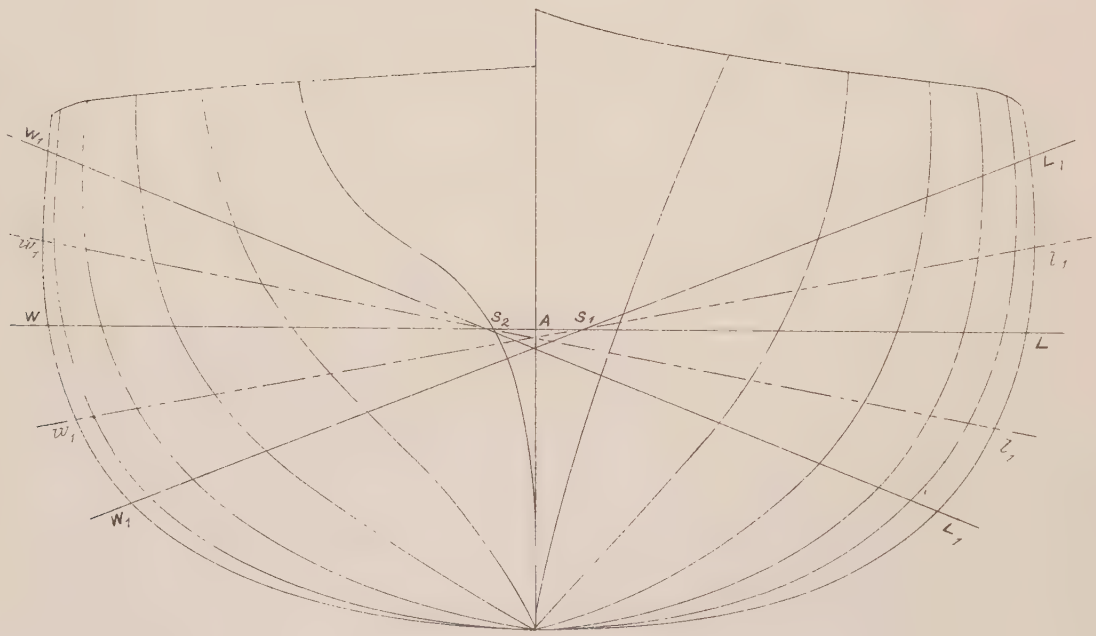


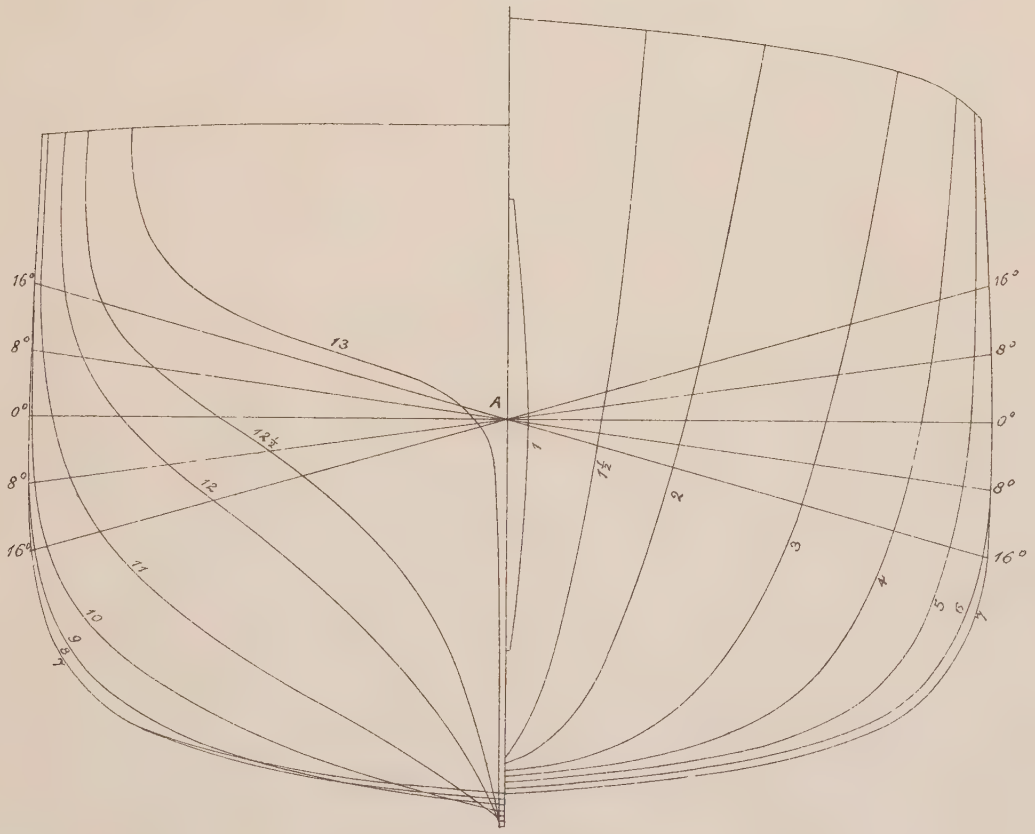
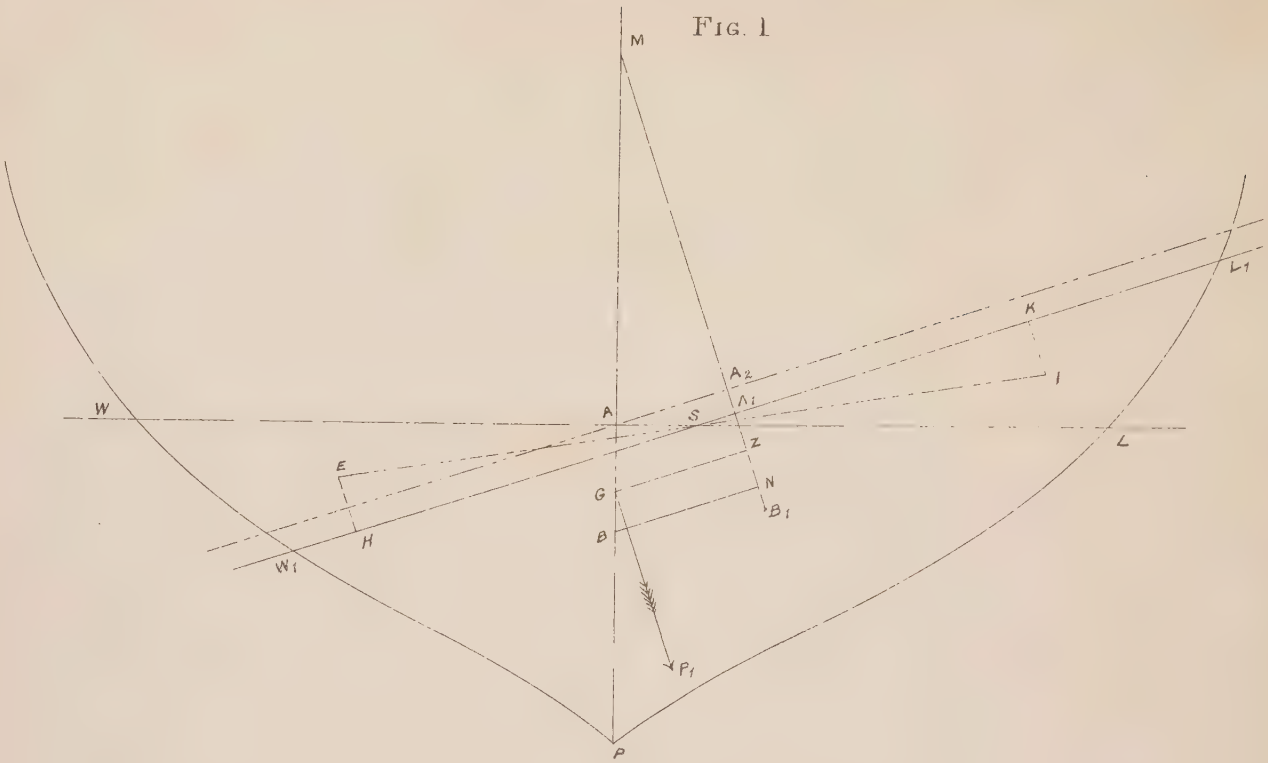

16°
8°
0°
8°
16°
13
12½
12
11
10
9½
9
A
1
1½
2
3
4
5
6
7
16°
8°
0°
8°
16°

FIG. 1


M
W
A
S
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W1
P1
P

FIG. 2

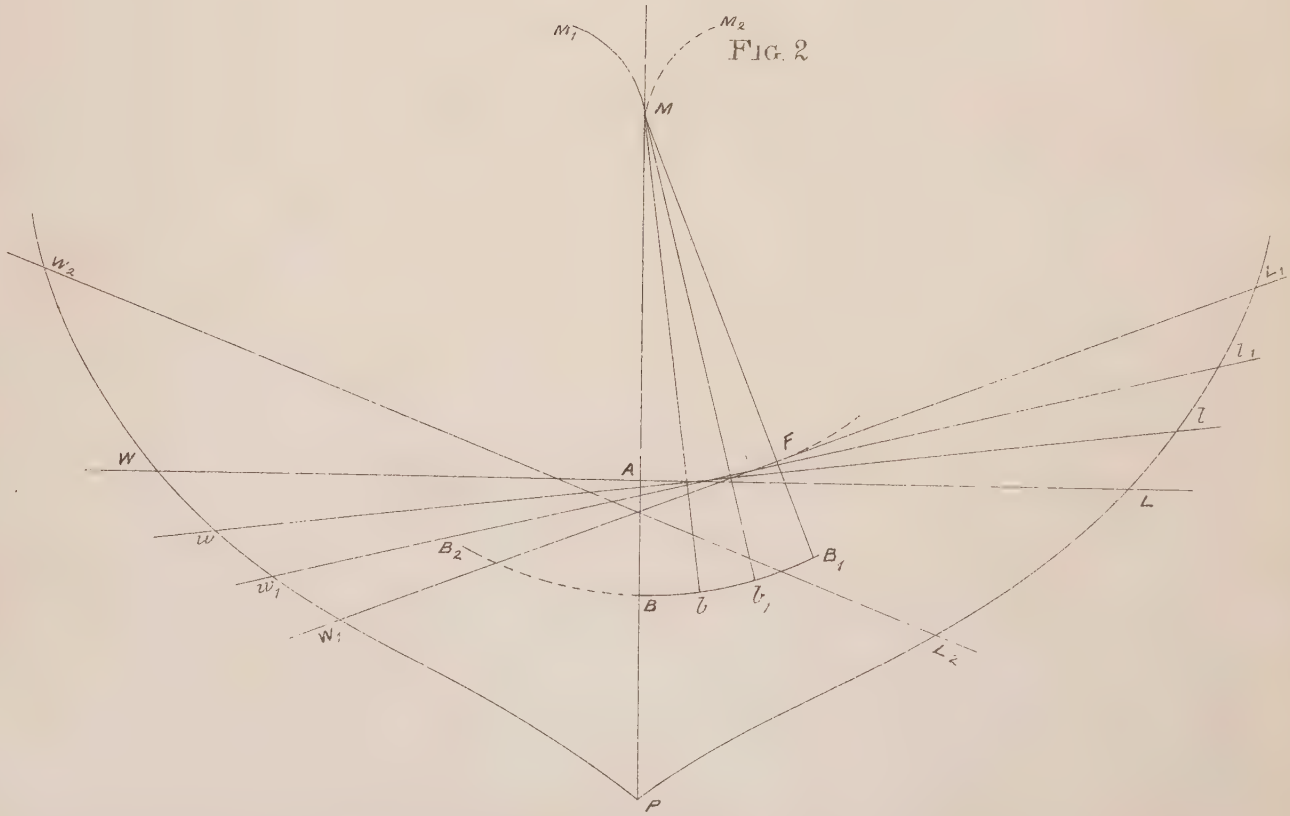

M1
M2
M
W2
W
A
F
L
L1
l1
l
w
w1
B2
B1
B
b
b1
W1
L2
P

Fig. 1

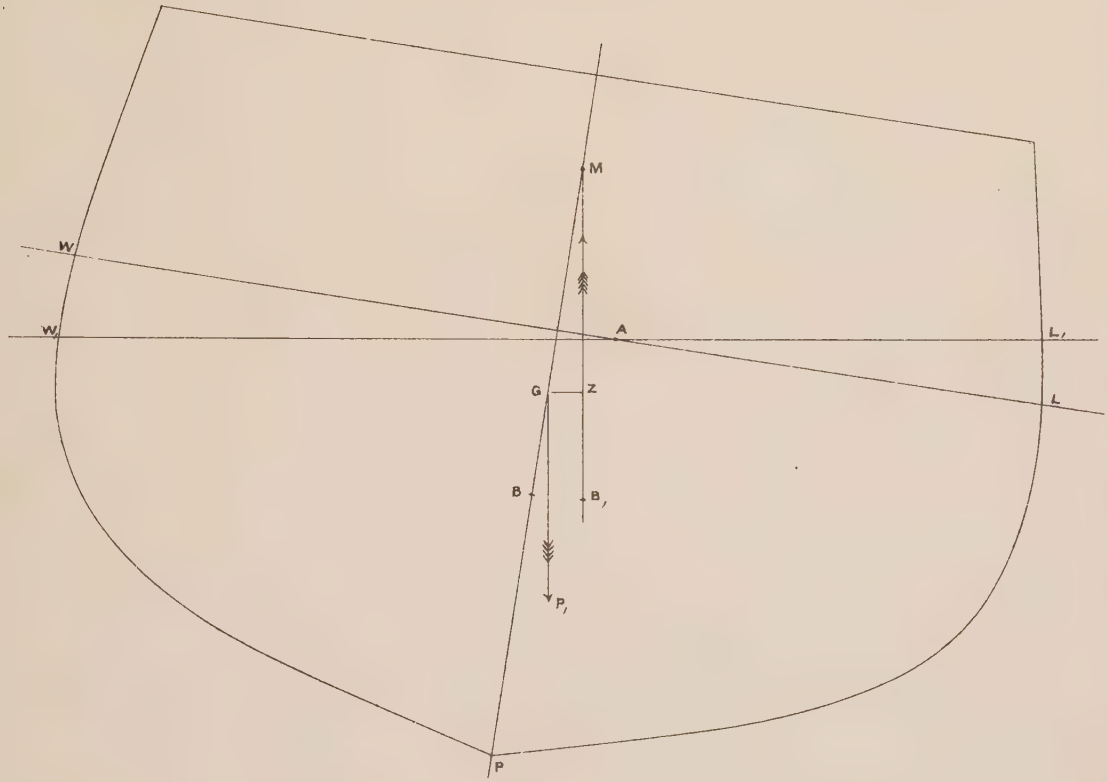


Fig. 2

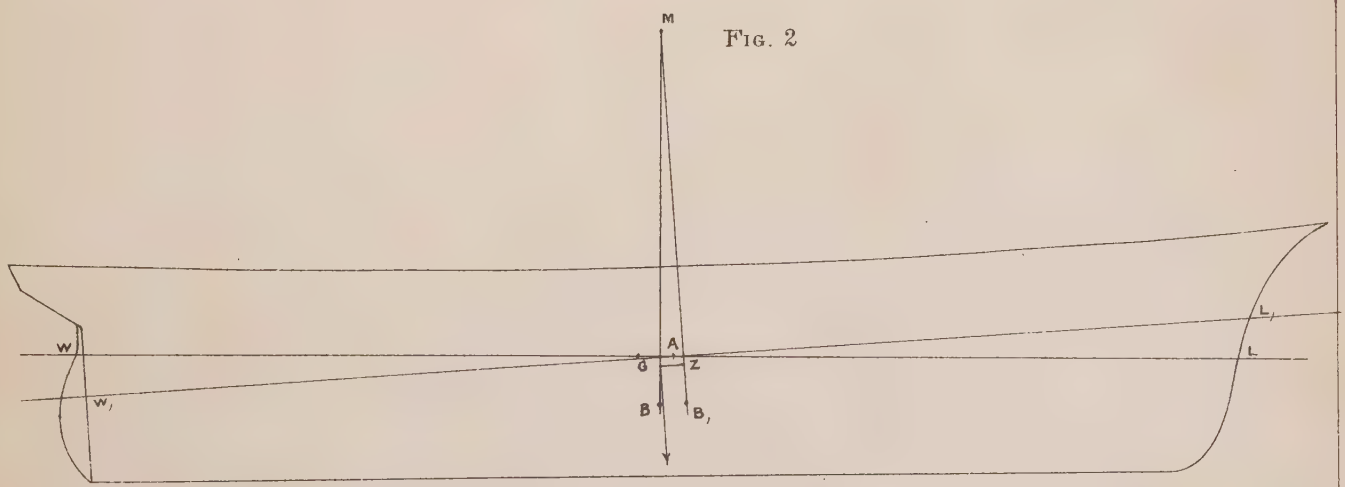


FIG. 1

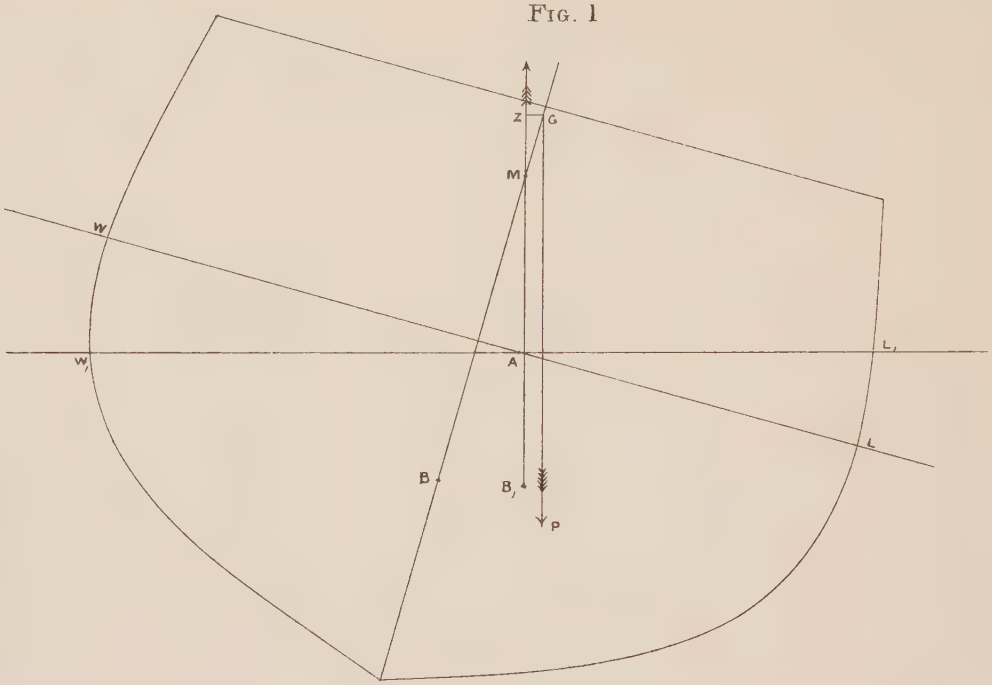


FIG. 2

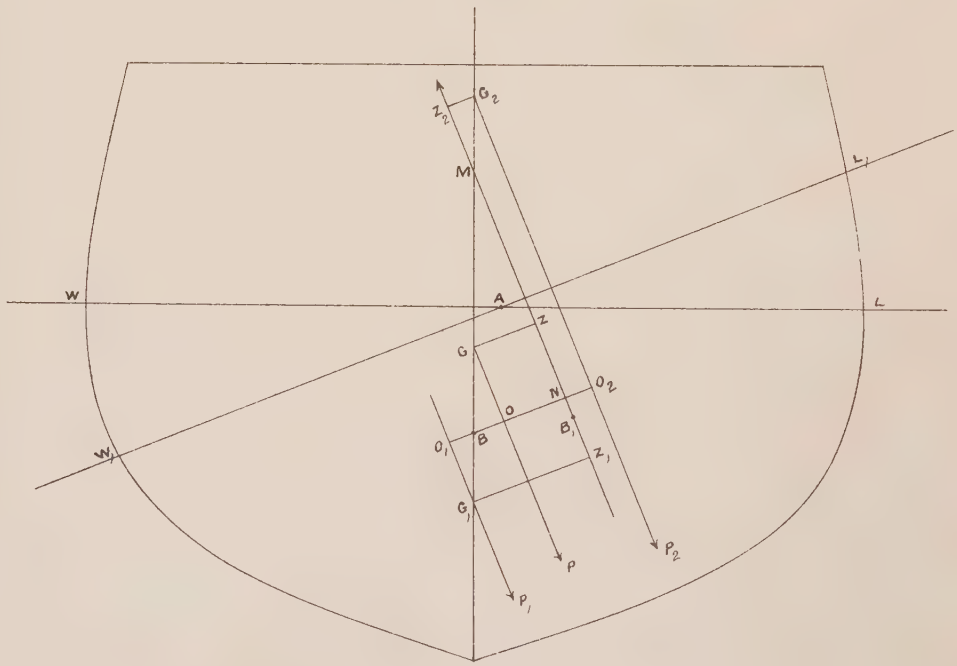


Fig. 1

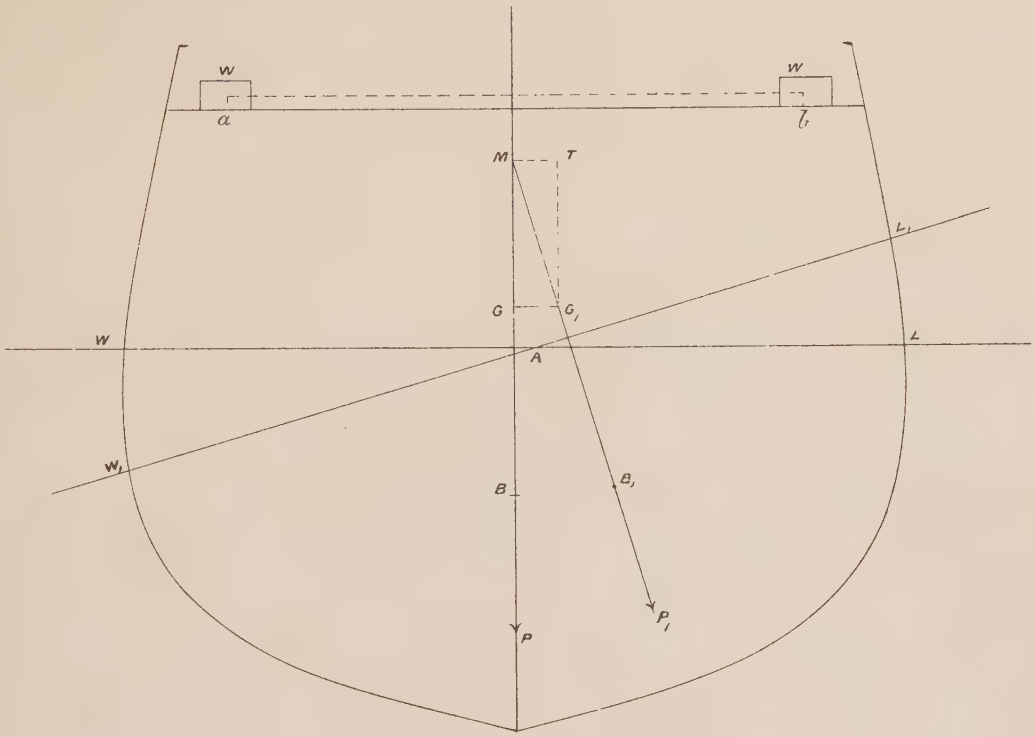


Fig. 2

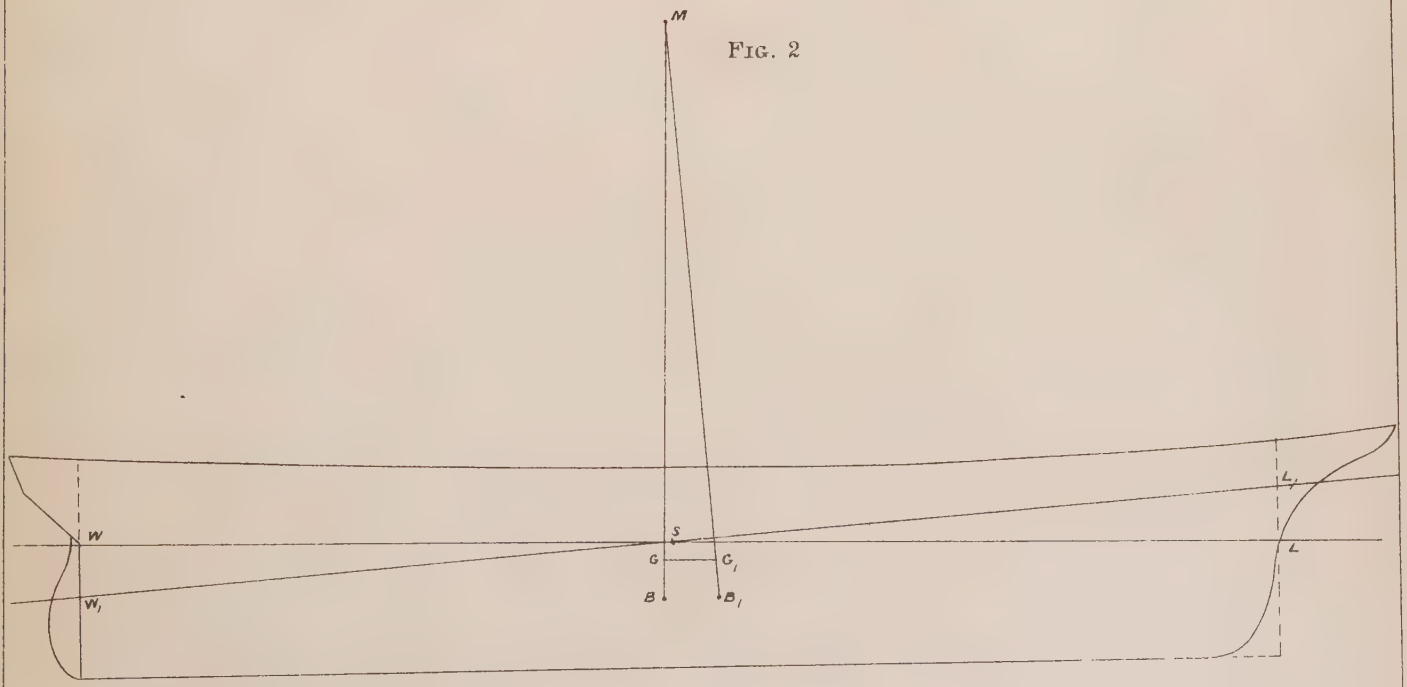


FIG. 1

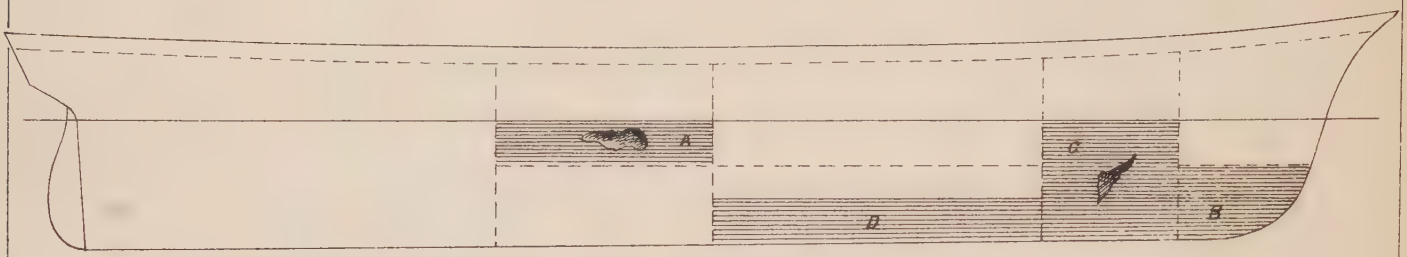


FIG. 2

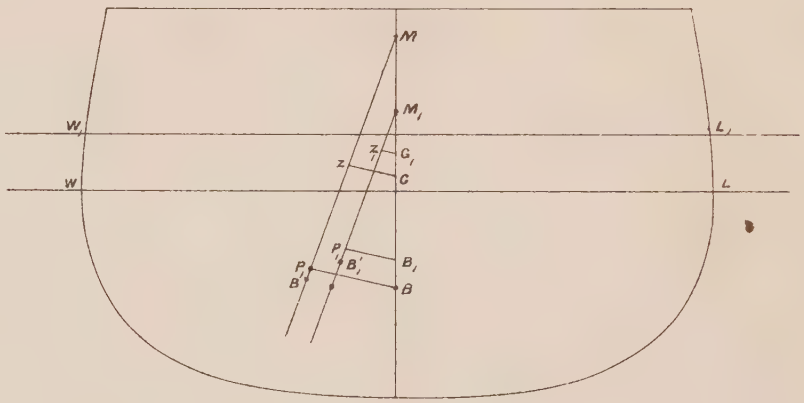


FIG. 3

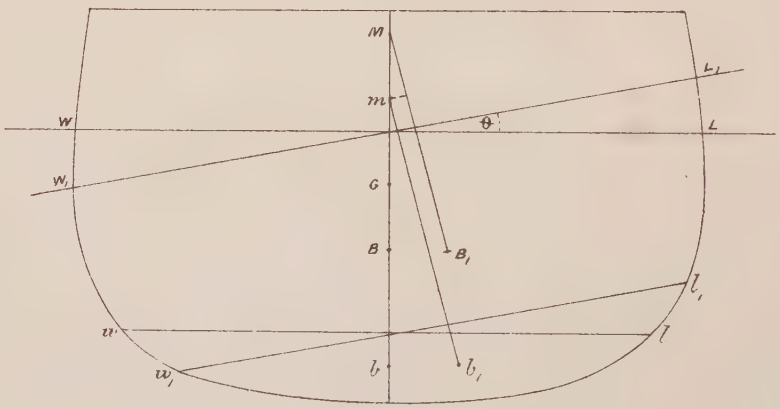


FIG. 1

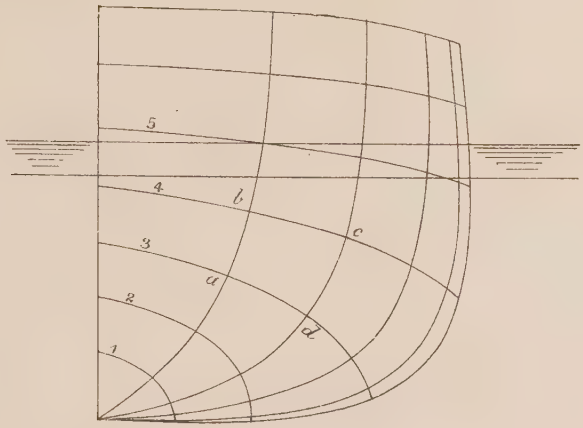


FIG. 2

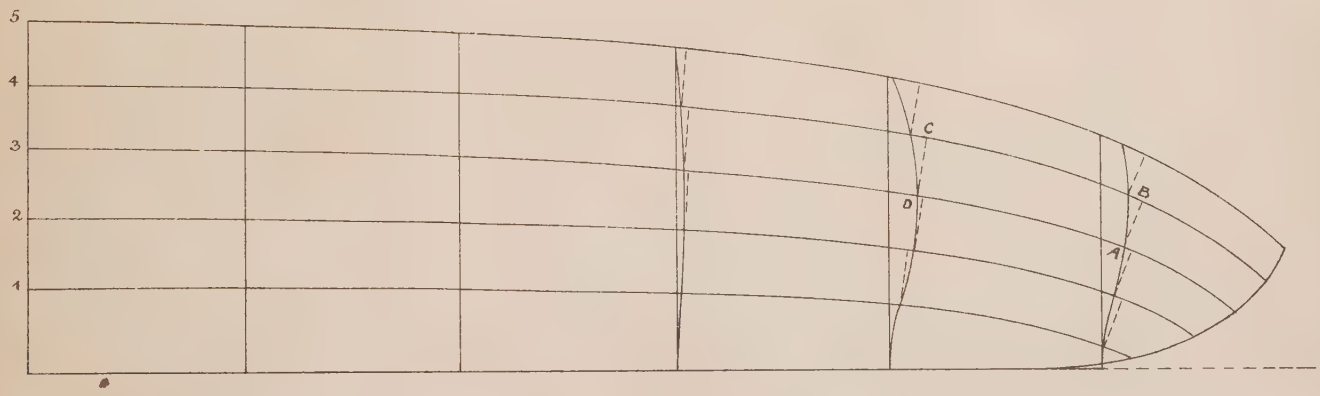


FIG. 3

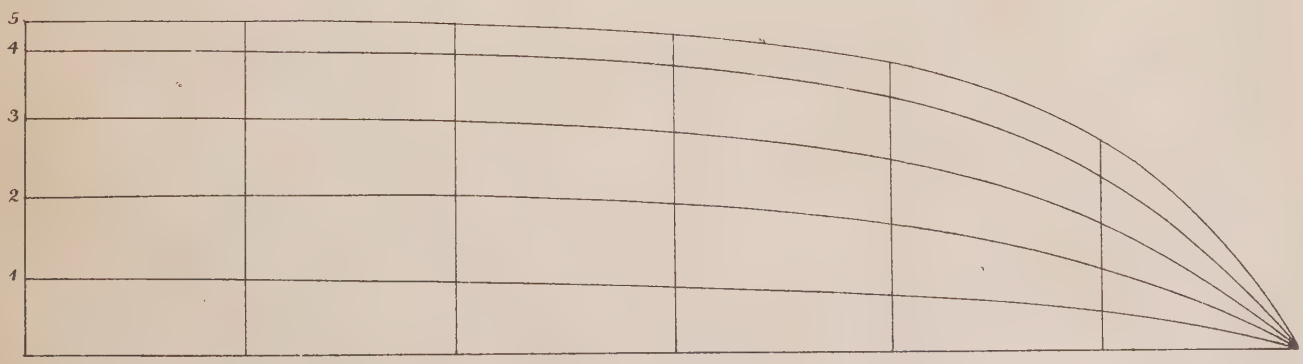


FIG. 1

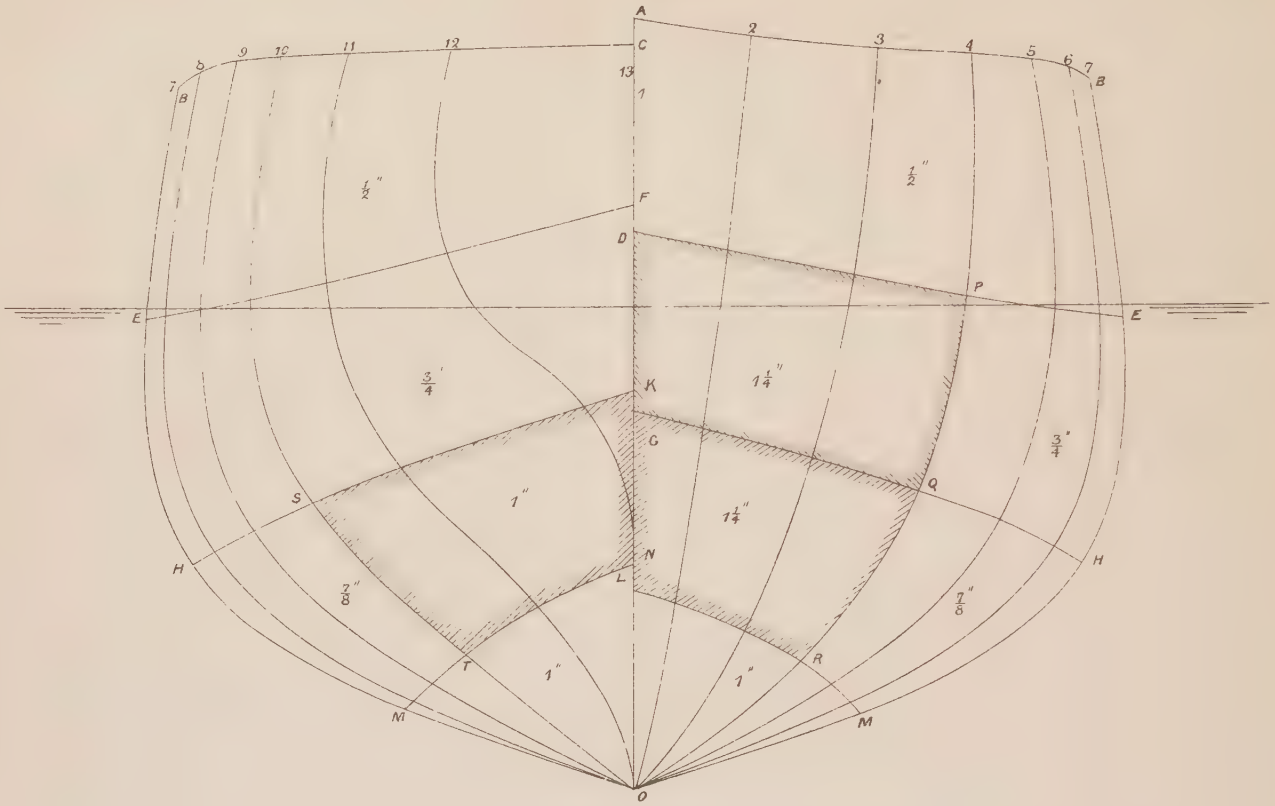

A
2
3
4
5
6
7
B
C
13
1
9
10
11
12
b
7
B
½"
½"
F
D
P
E
E
¾"
K
1¼"
¾"
G
S
1"
1¼"
Q
H
H
N
L
⅞"
⅞"
T
1"
1"
R
M
M
O

FIG. 2

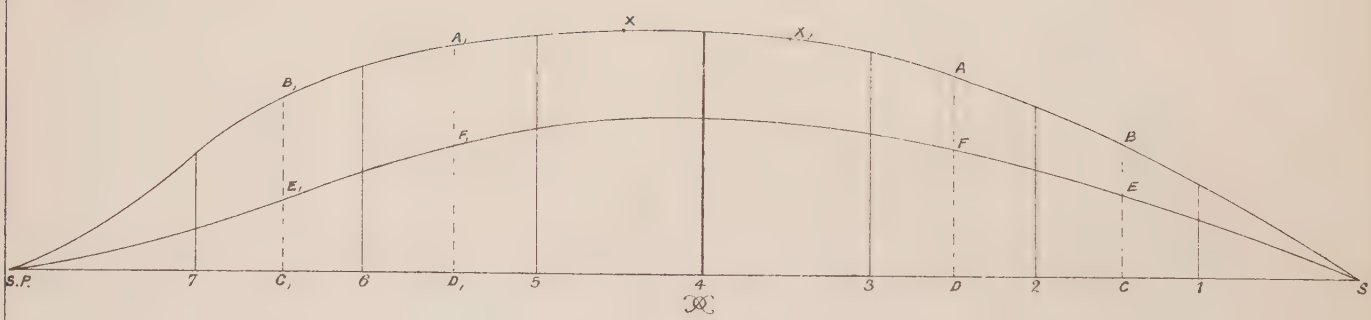

X
A,
X,
A
B,
B
F,
F
E,
E
S.P.
7
C,
6
D,
5
4
3
D
2
C
1
S

FIG. 1

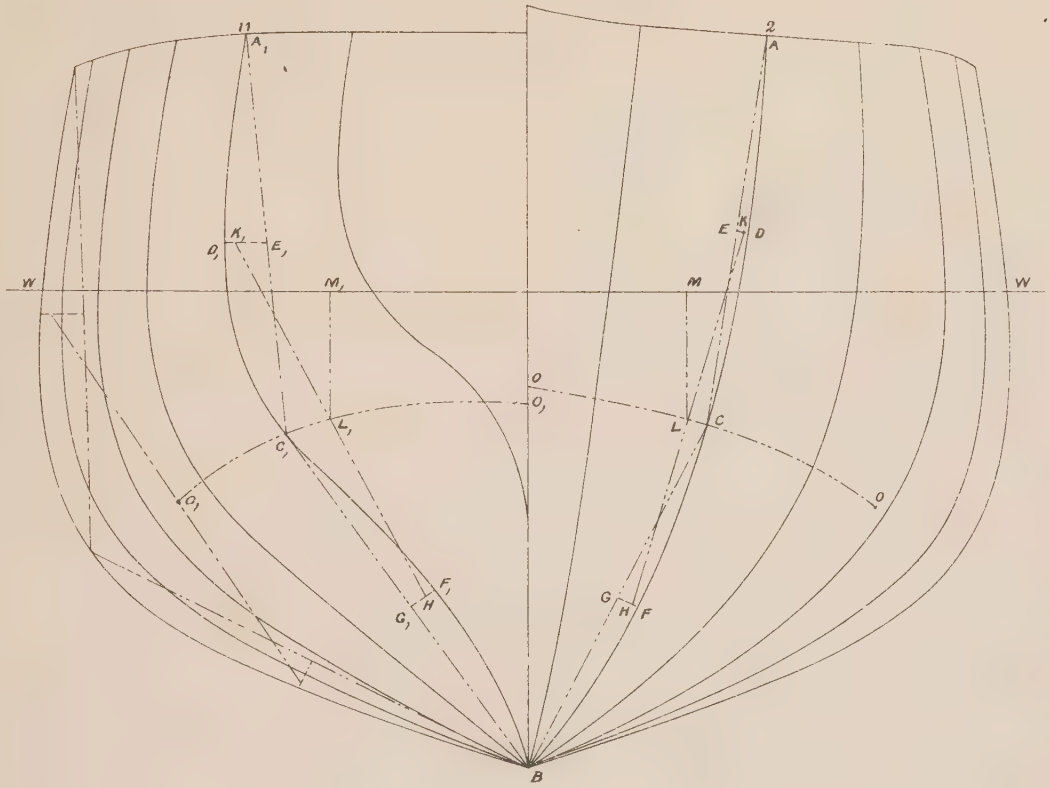

11
A1
2
A
K1
E1
D1
E
K
D
W
M1
M
W
O
O1
L1
L
C1
C
O1
O
F1
H
G1
G
H
F
B

FIG. 2

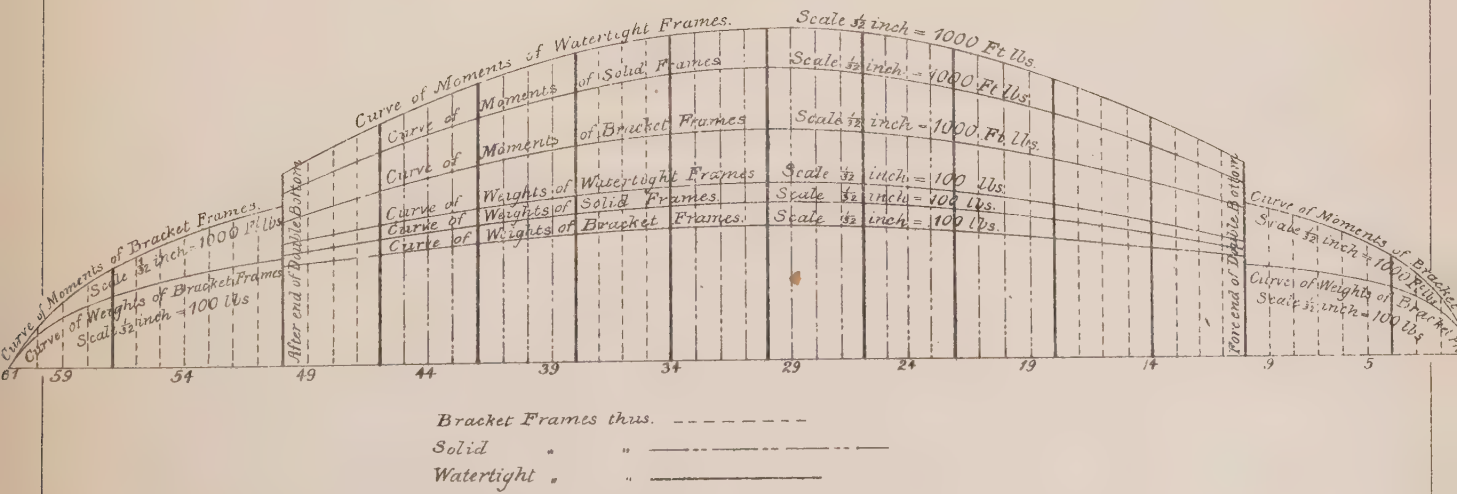

Curve of Moments of Watertight Frames. Scale 1/32 inch = 1000 Ft lbs.
Curve of Moments of Solid Frames Scale 1/32 inch = 1000 Ft lbs.
Curve of Moments of Bracket Frames Scale 1/32 inch = 1000 Ft lbs.
Curve of Weights of Watertight Frames Scale 1/32 inch = 100 lbs.
Curve of Weights of Solid Frames. Scale 1/32 inch = 100 lbs.
Curve of Weights of Bracket Frames. Scale 1/32 inch = 100 lbs.
Curve of Moments of Bracket Frames. Scale 1/32 inch = 1000 Ft lbs.
Curve of Weights of Bracket Frames Scale 1/32 inch = 100 lbs
After end of Double Bottom
Fore end of Double Bottom
Curve of Moments of Bracket Frames Scale 1/32 inch = 1000 Ft lbs
Curve of Weights of Bracket Frames Scale 1/32 inch = 100 lbs
61
59
54
49
44
39
34
29
24
19
14
9
5
Bracket Frames thus.
Solid " "
Watertight " "

FIG. 1

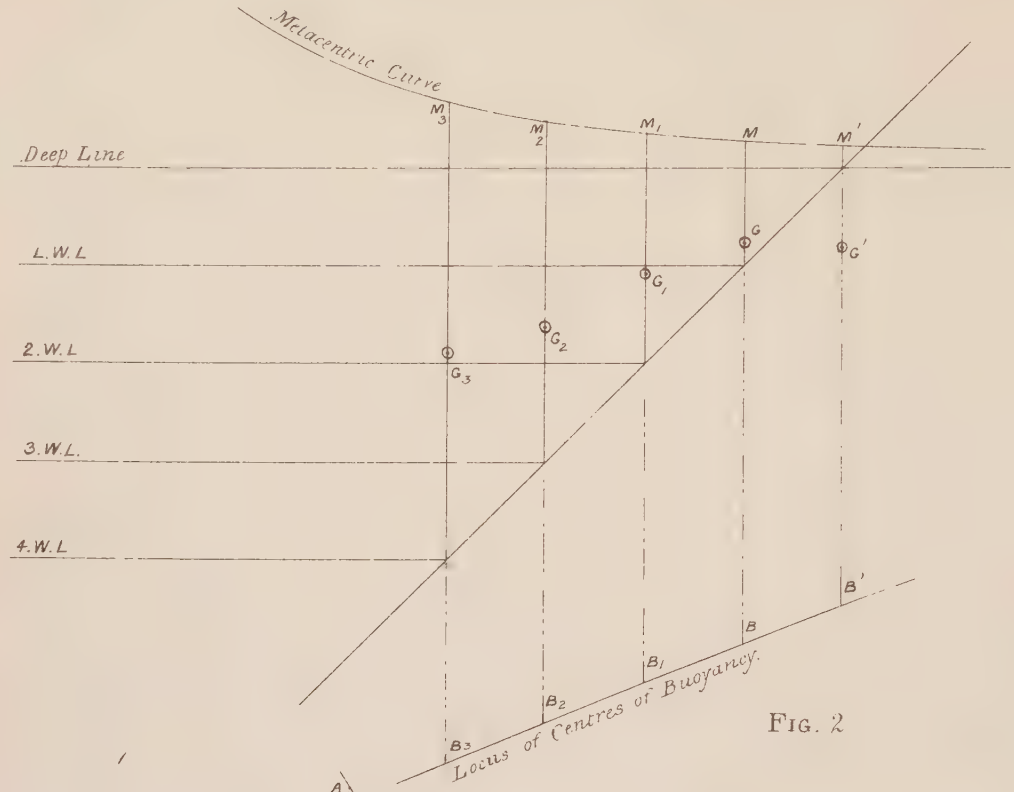
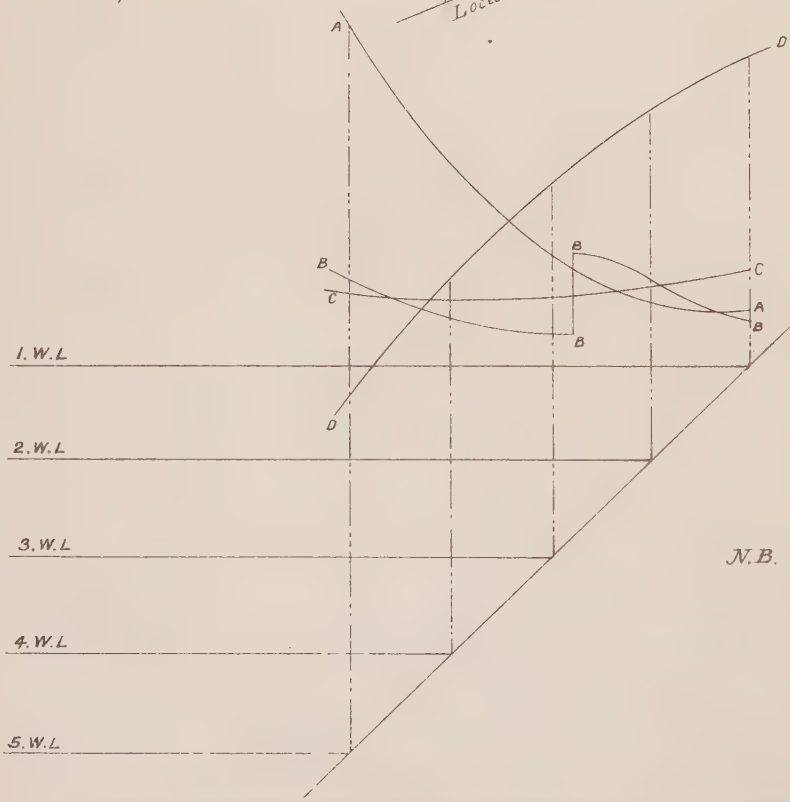


FIG. 2



References to curves in Fig 2

A.A. Gunboats in H.M. Navy.

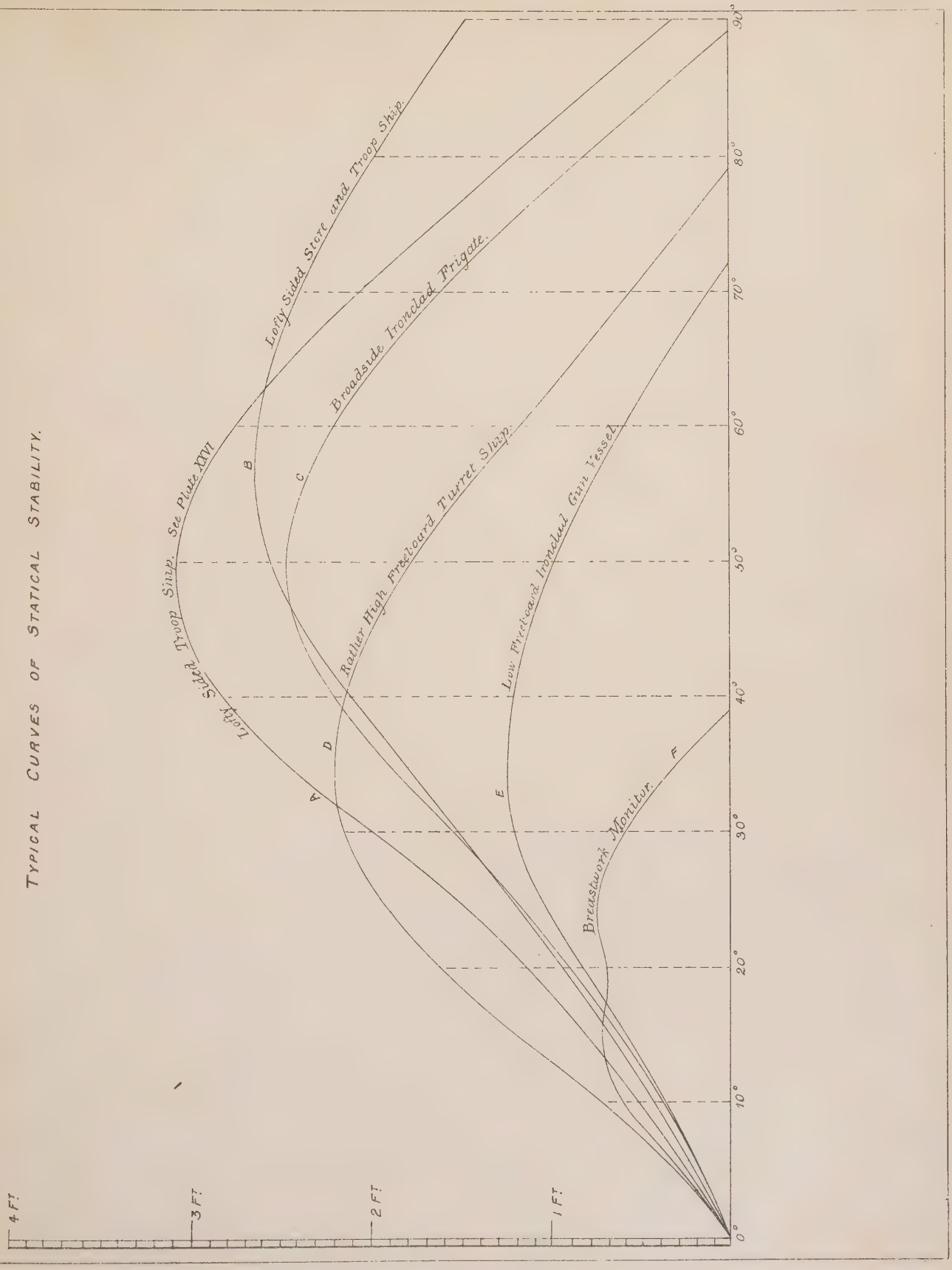
B.B. Ships with projecting Armour Shelf as H.M.S. Devastation.

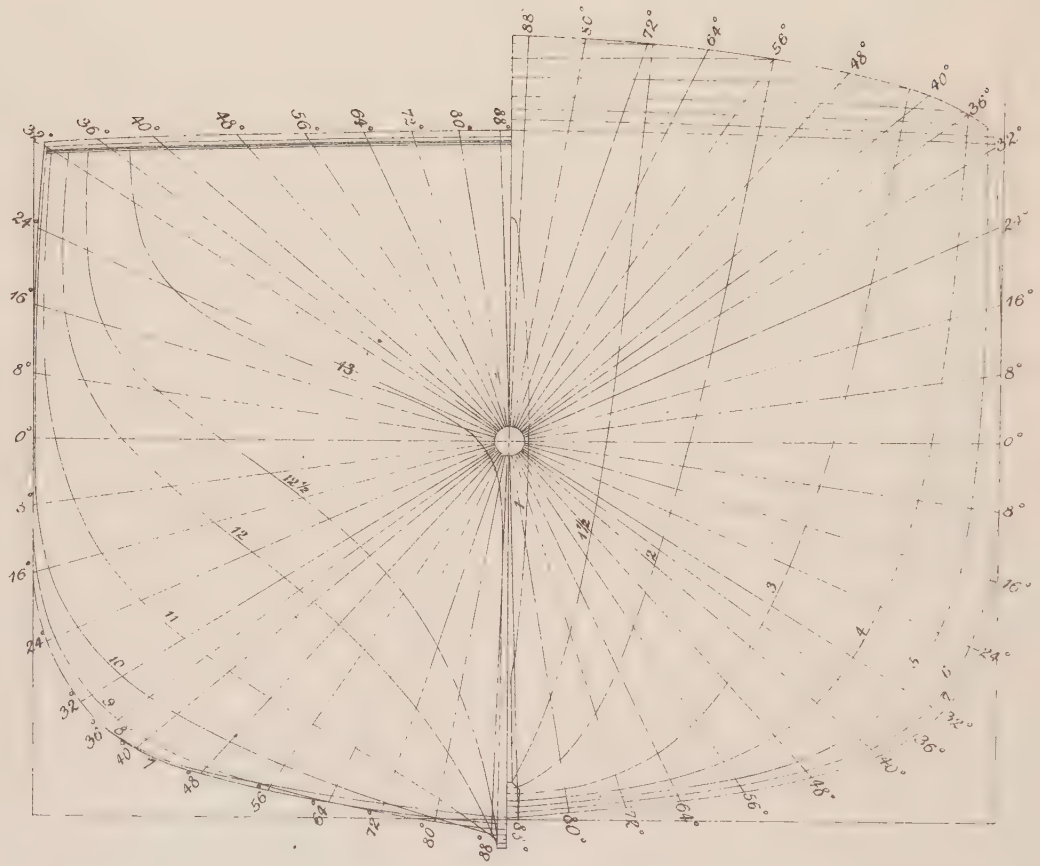
C.C. Ordinary curve of a broadside Iron-clad Ship.

D.D. Man of War Brigs with a very rising floor.

N.B. The curve shown by Fig 1. is of the character ordinarily met with.

Typical Curves of Statical Stability.




88°
80°
72°
64°
56°
48°
40°
36°
32°
24°
16°
8°
0°
8°
16°
24°
32°
36°
40°
48°
56°
64°
72°
80°
88°
13
12½
12
11
10
9
8
7
6
5
4
3
2
1½
1
½

Typical Curves of Dynamical Stability.

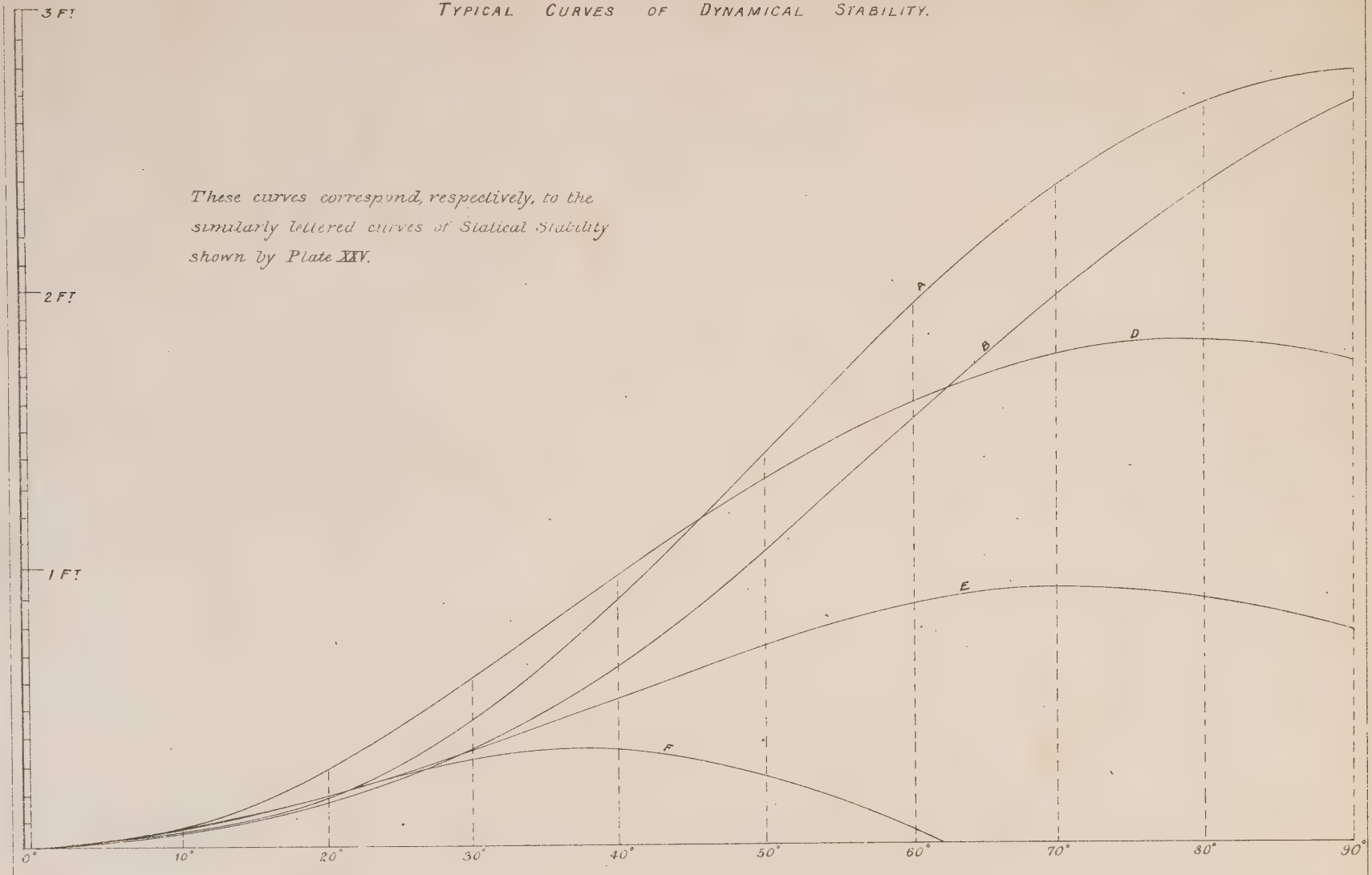


Plate XXVII

FIG. 1

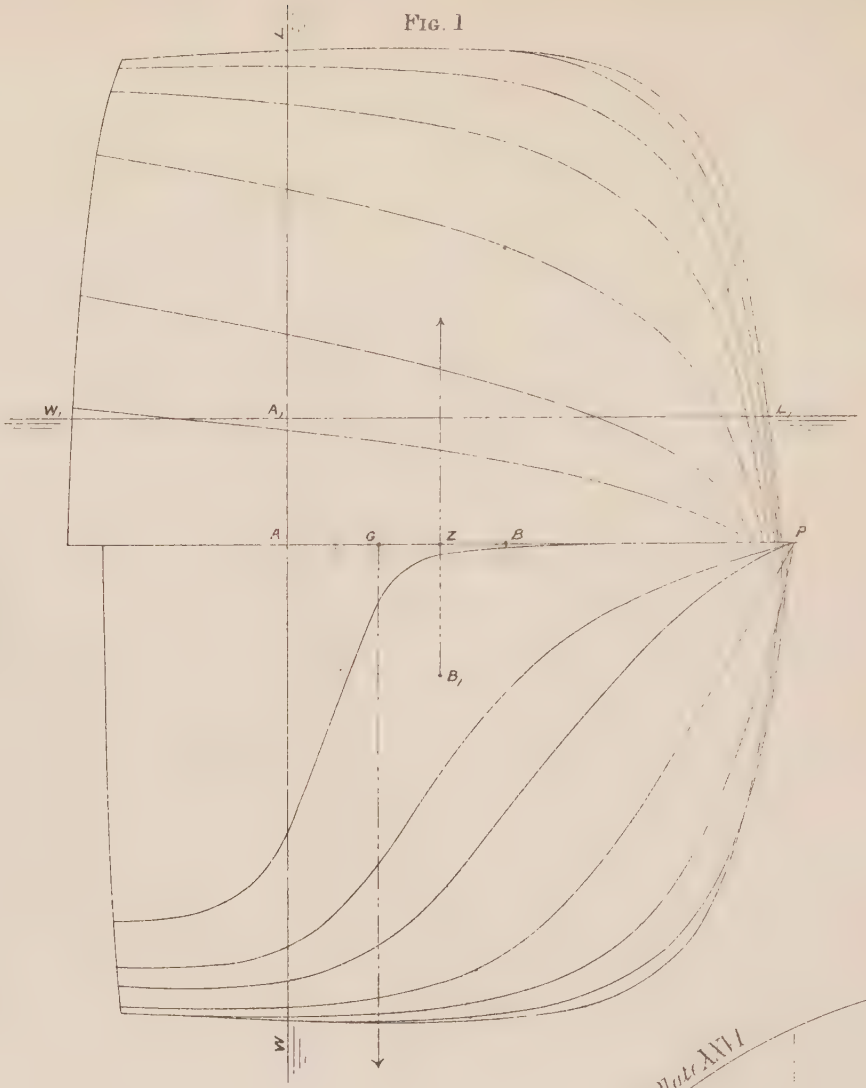

L
W,
A,
L,
A
G
Z
B
P
B,
W

FIG. 2

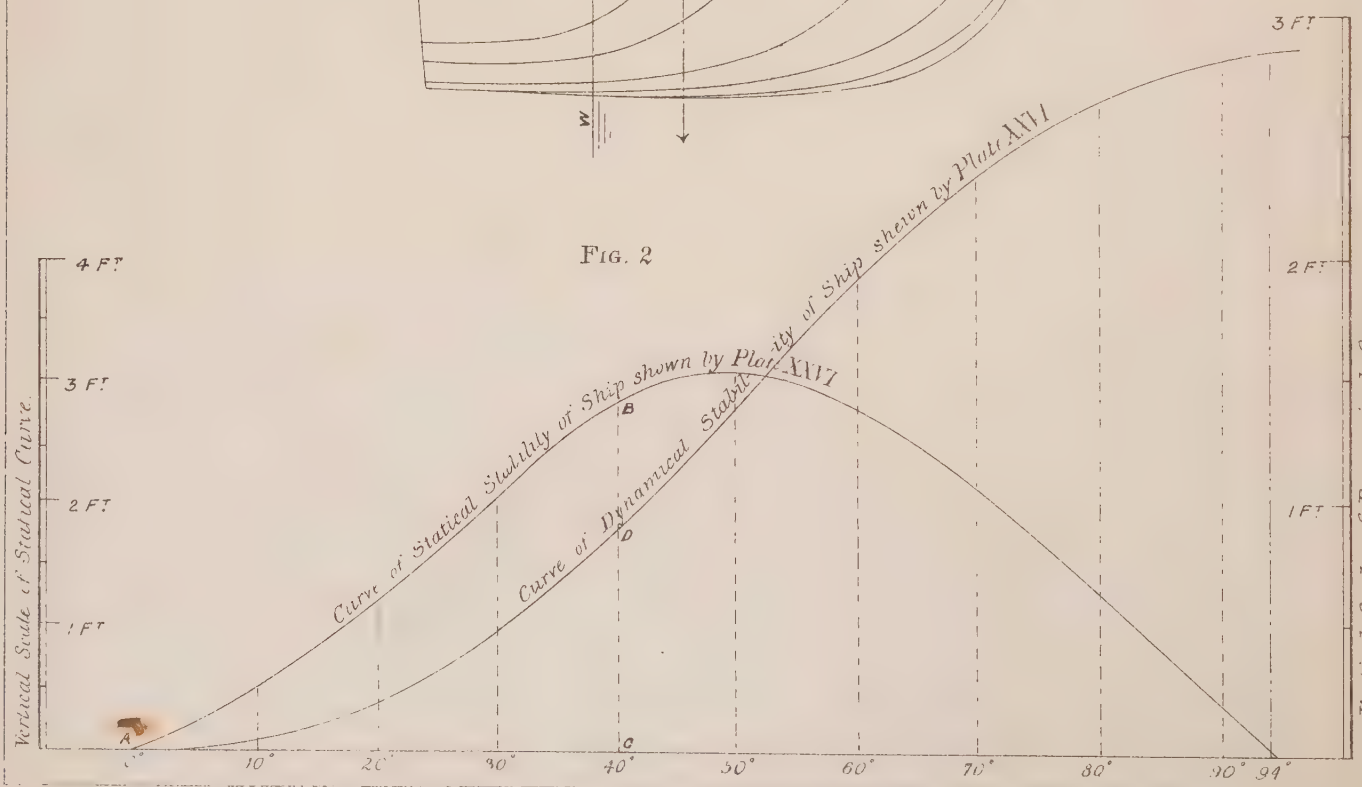

4 FT
3 FT
2 FT
1 FT
Vertical Scale of Statical Curve.
Curve of Statical Stability of Ship shown by Plate XVII
Curve of Dynamical Stability of Ship shewn by Plate XVII
B
D
A
C
0°
10°
20°
30°
40°
50°
60°
70°
80°
90°
94°
3 FT
2 FT
1 FT
Vertical Scale of Dynamical Curve.

FIG. 1

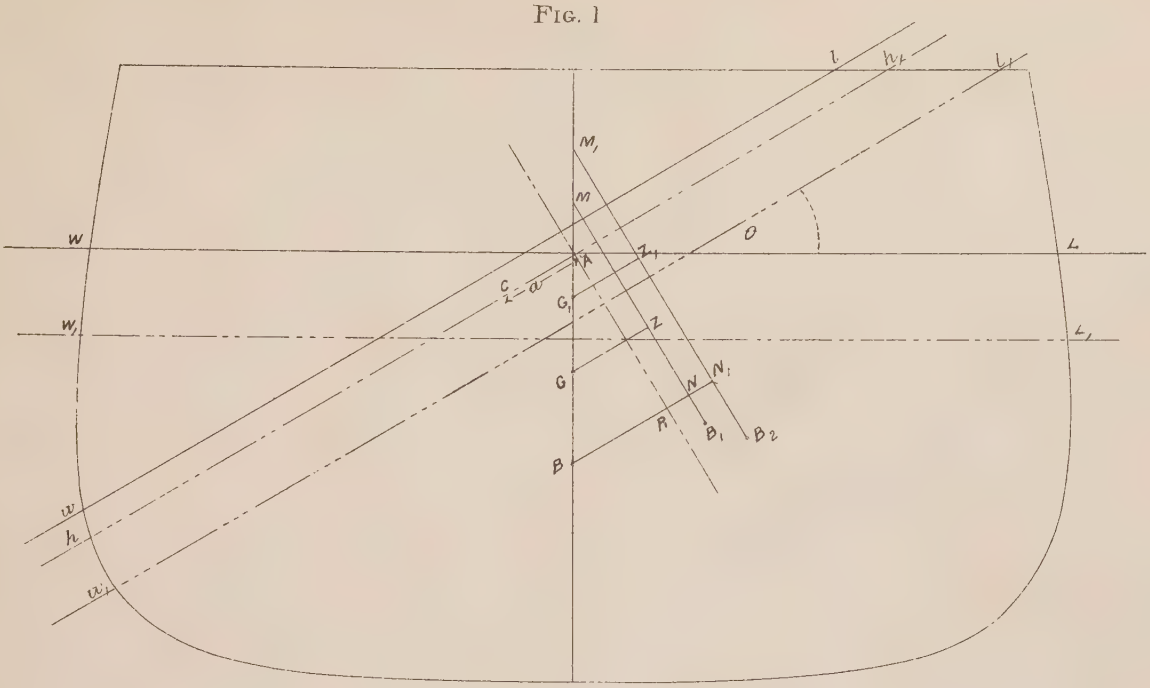
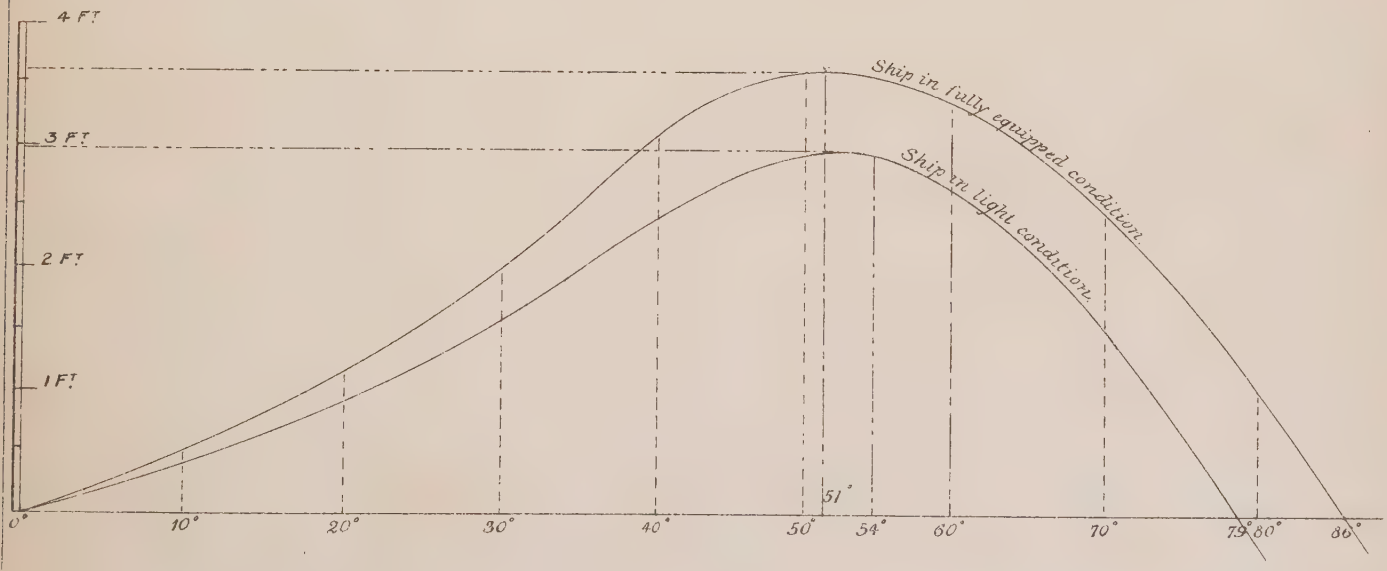

W
W1
L
L1
M
M1
A
Z
Z1
G
G1
N
N1
R
B
B1
B2
O
C
a
w
h
w1

FIG. 2


4 FT
3 FT
2 FT
1 FT
Ship in fully equipped condition.
Ship in light condition.
0°
10°
20°
30°
40°
50°
51°
54°
60°
70°
79°
80°
86°

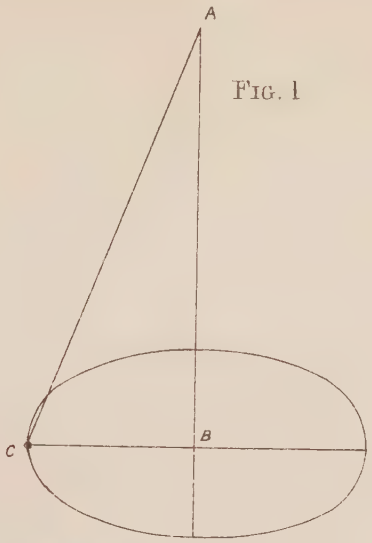


Fig. 1

Fig. 3

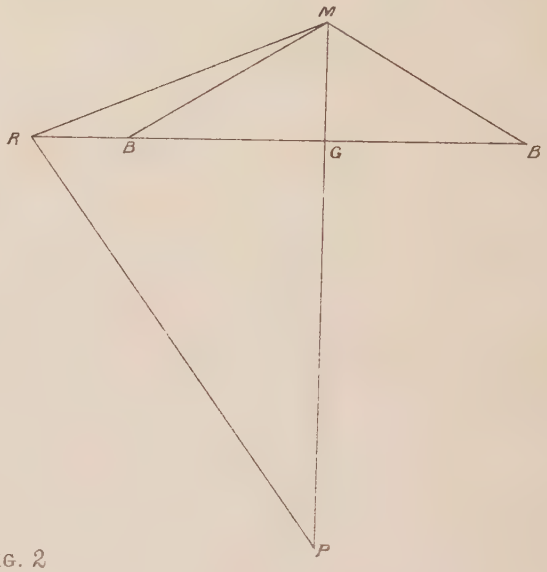
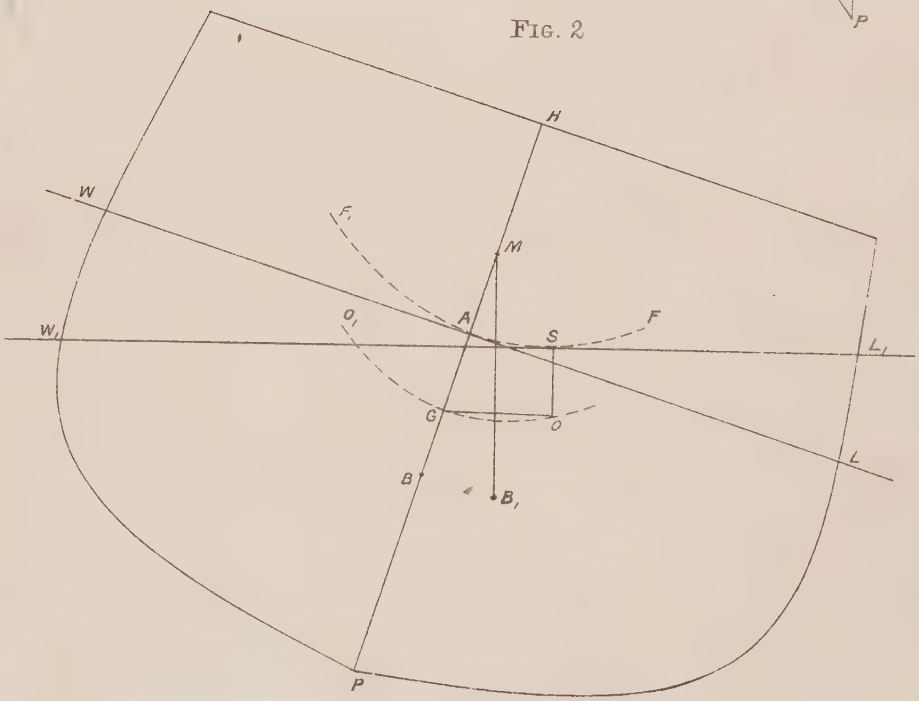
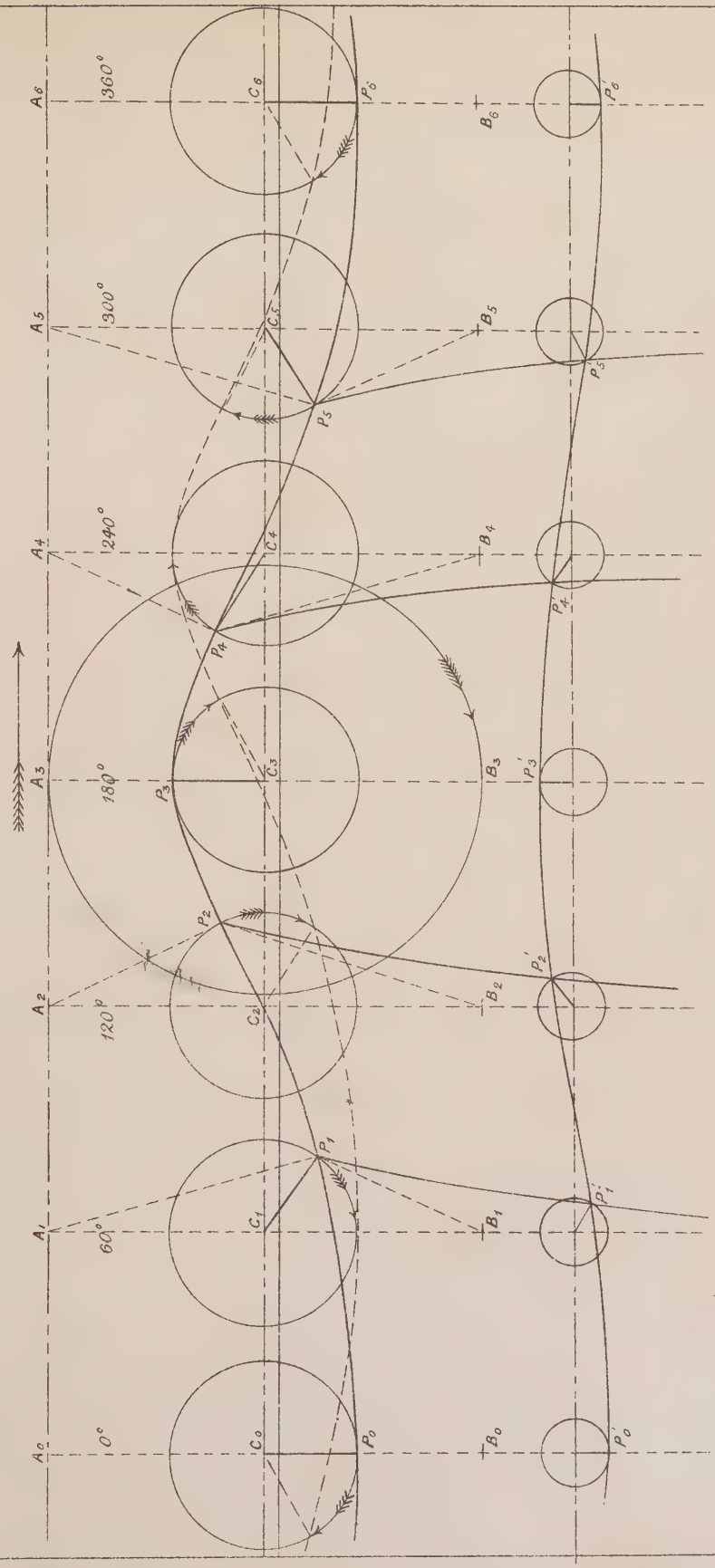
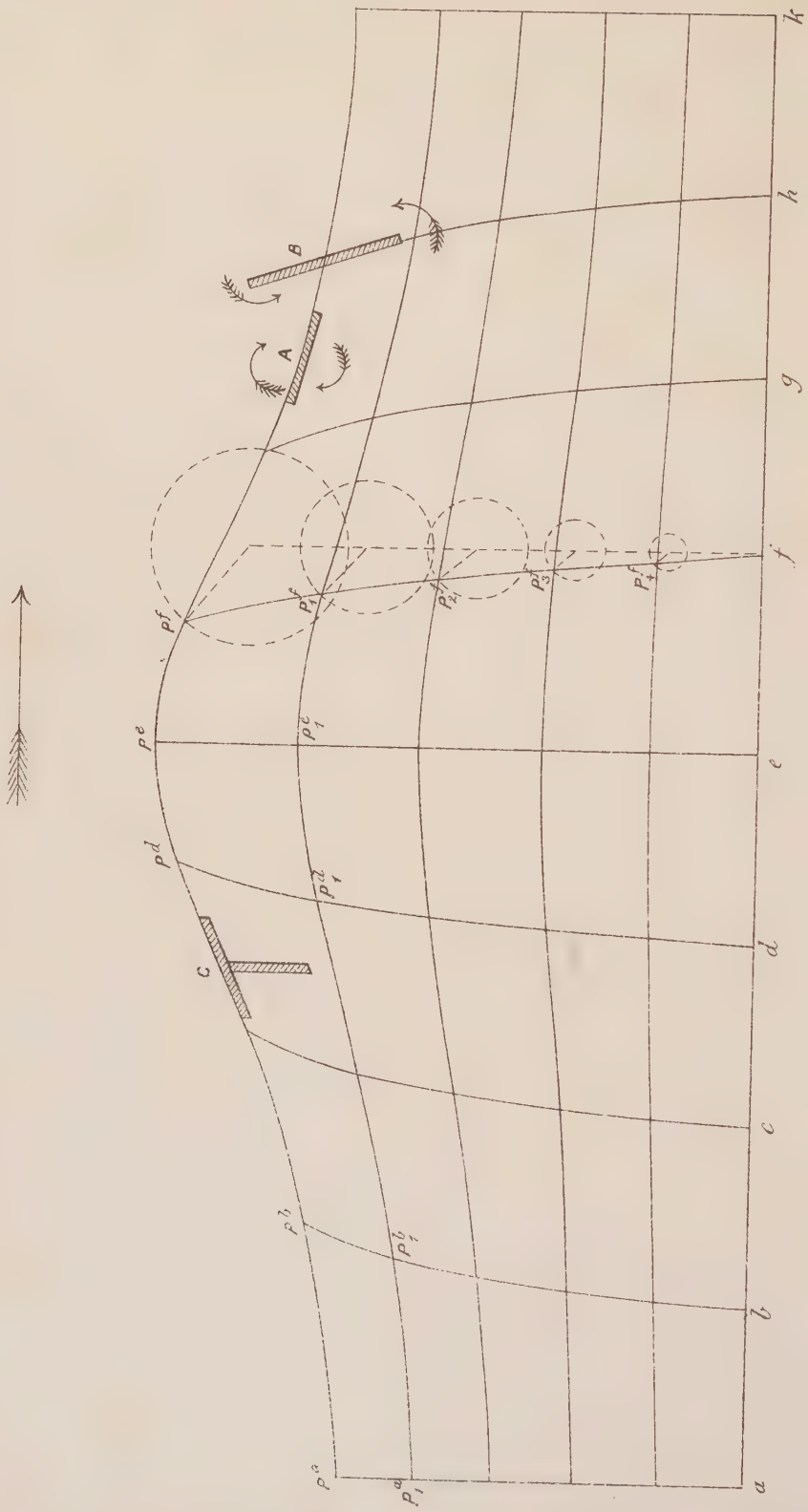
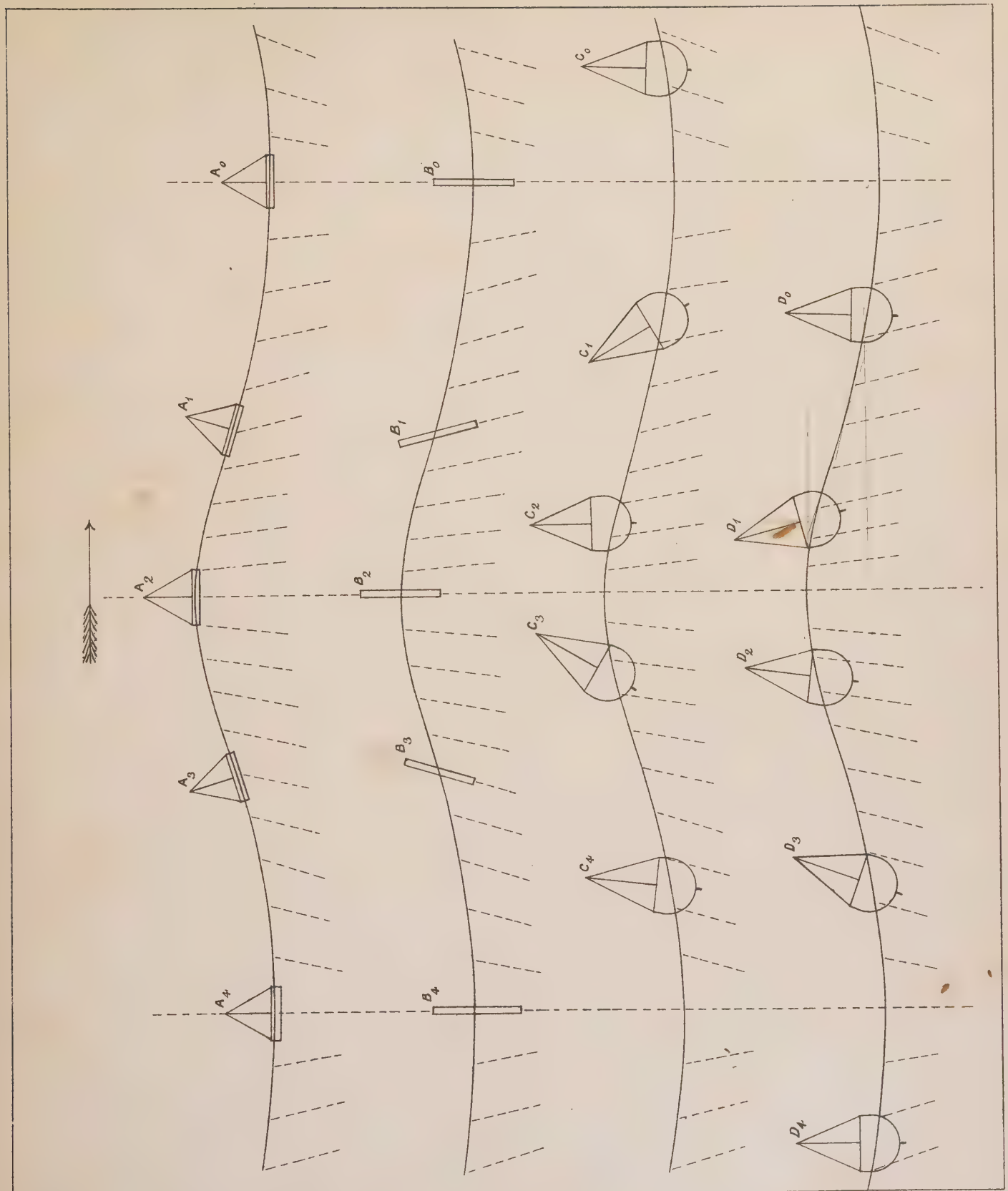


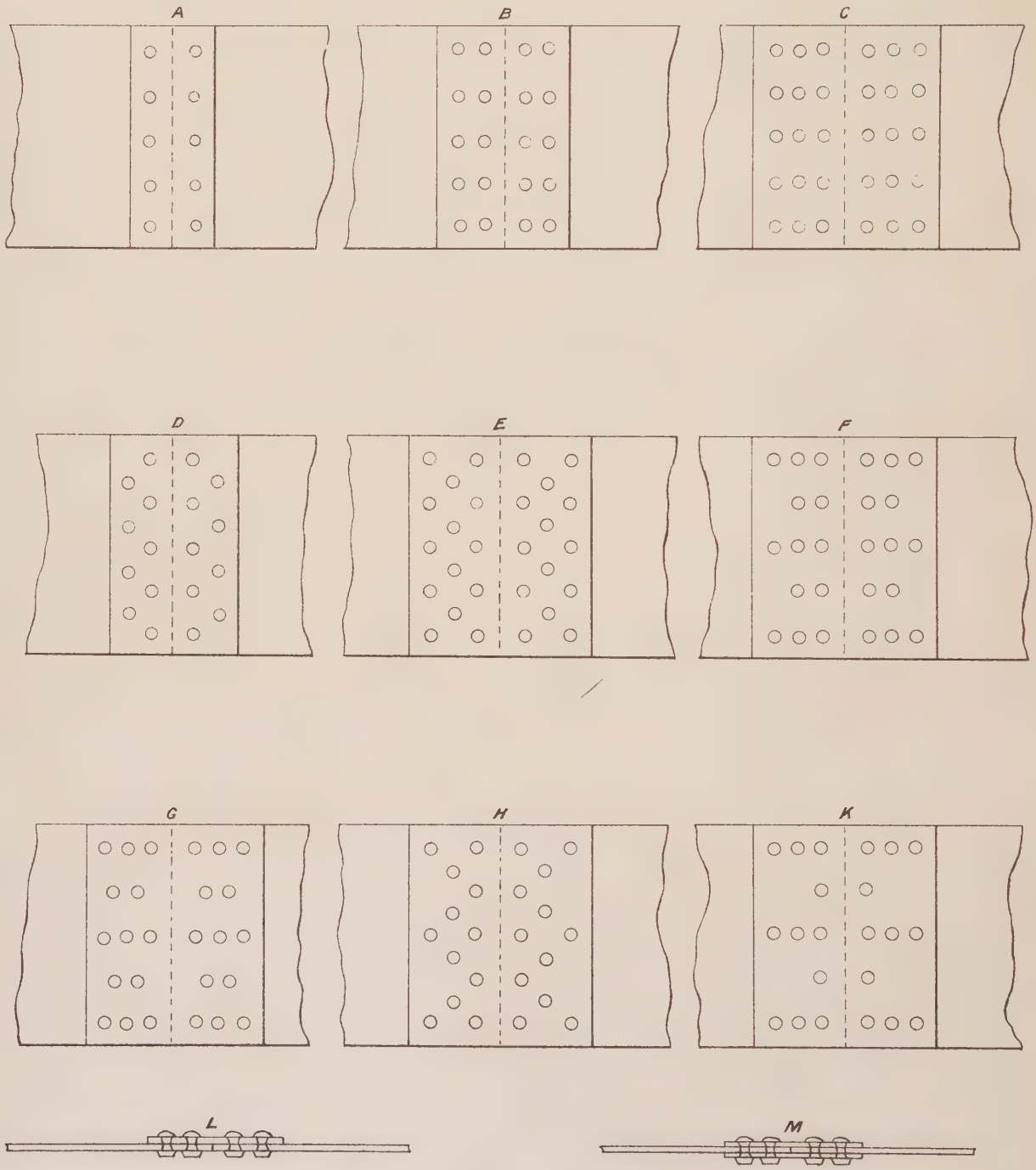
Fig. 2




A6
360°
C6
P'6
B6
P6
A5
300°
C5
B5
P5
P'5
A4
240°
C4
B4
P4
P'4
A3
180°
C3
B3
P3
P'3
A2
120°
C2
B2
P2
P'2
A1
60°
C1
B1
P1
P'1
A0
0°
C0
B0
P0
P'0


h
h
g
f
e
d
c
b
a
B
A
C
pf
pe
pd
pc
pb
pa


A0
B0
C0
D0
A1
B1
C1
D1
A2
B2
C2
D2
A3
B3
C3
D3
A4
B4
C4
D4


A
B
C
D
E
F
G
H
K
L
M

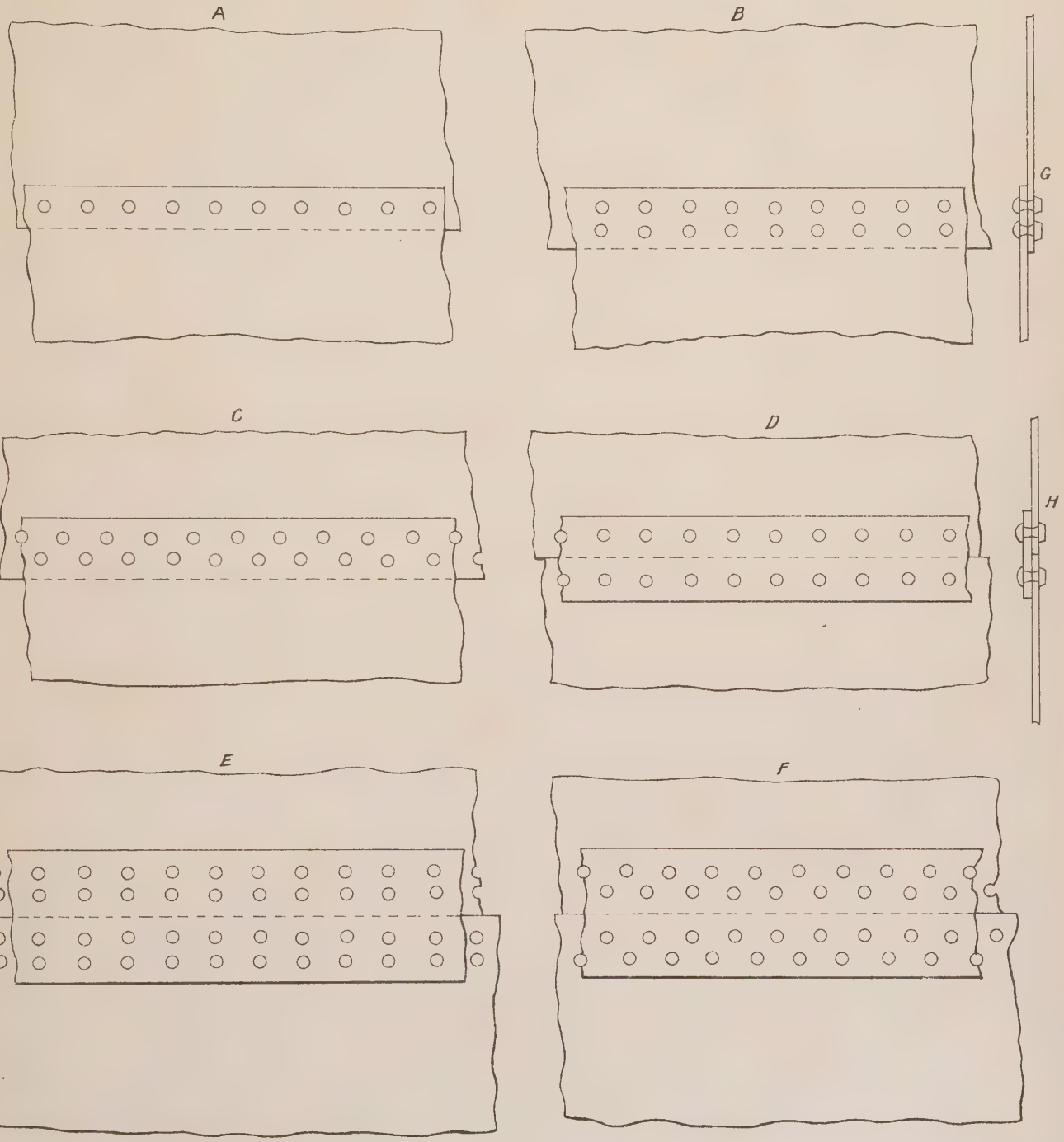

A
B
G
C
D
H
E
F

FIG. 1.

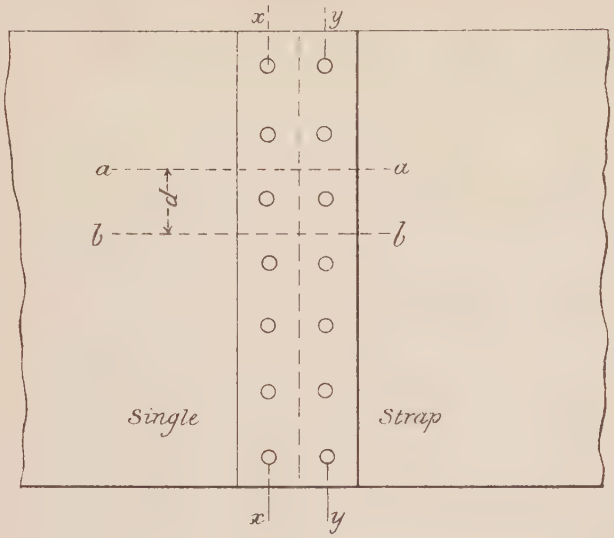


FIG. 2

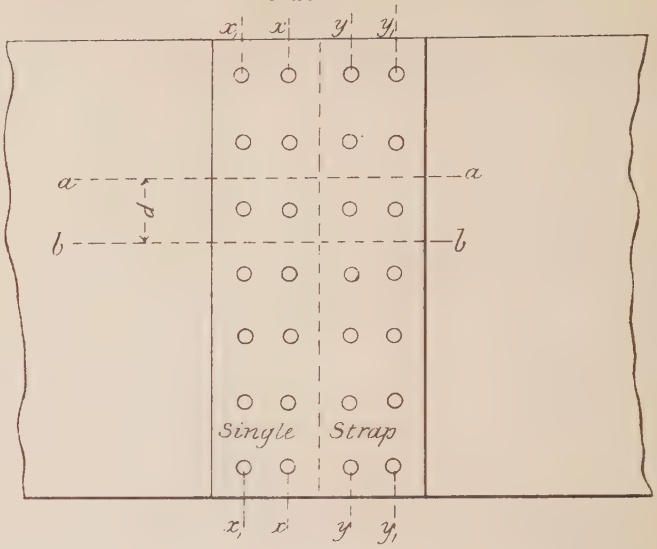


FIG. 3

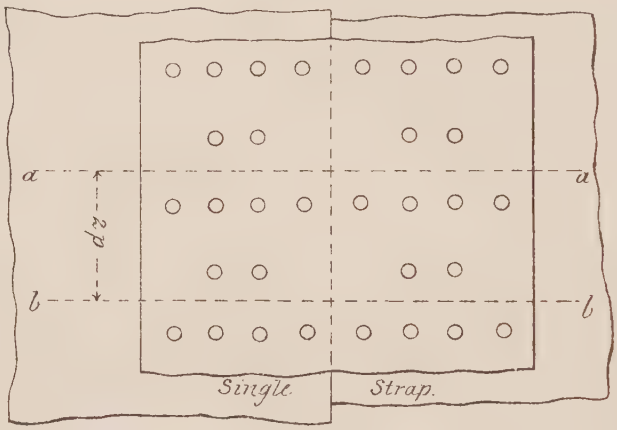


FIG. 4

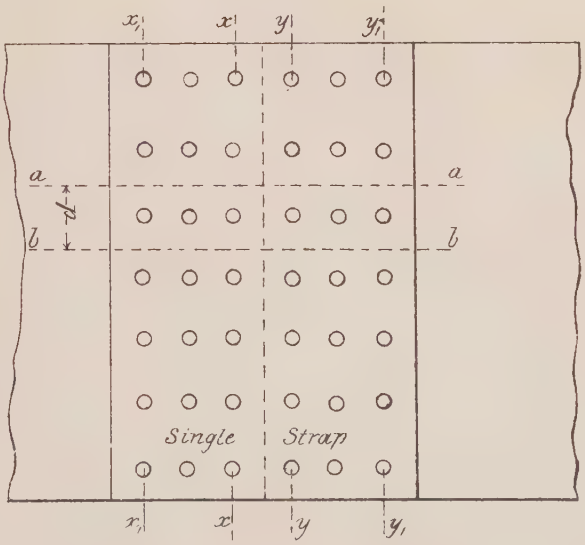
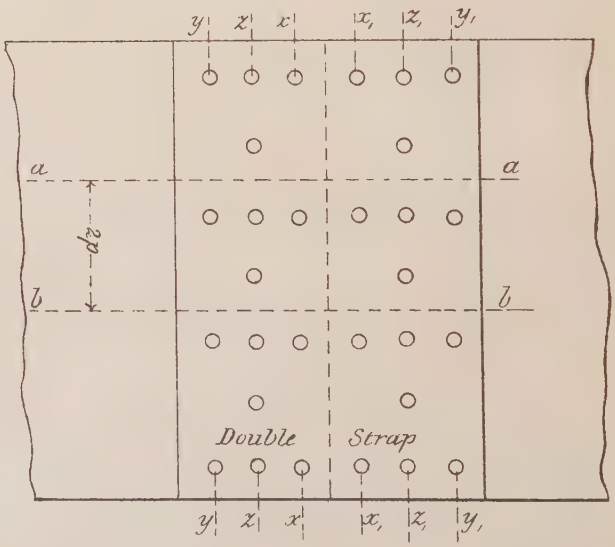
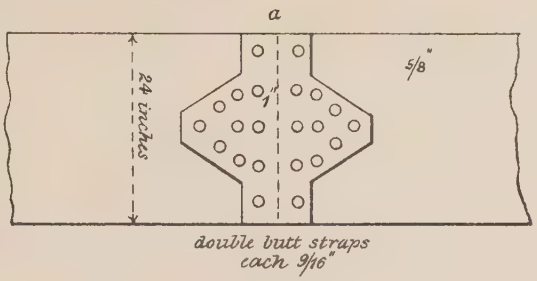
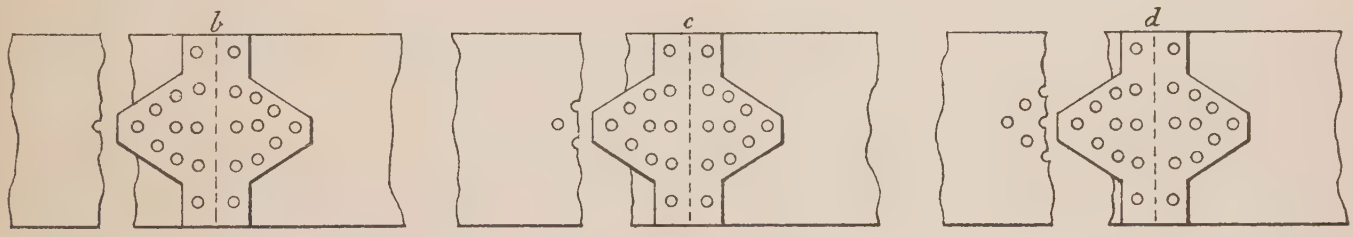
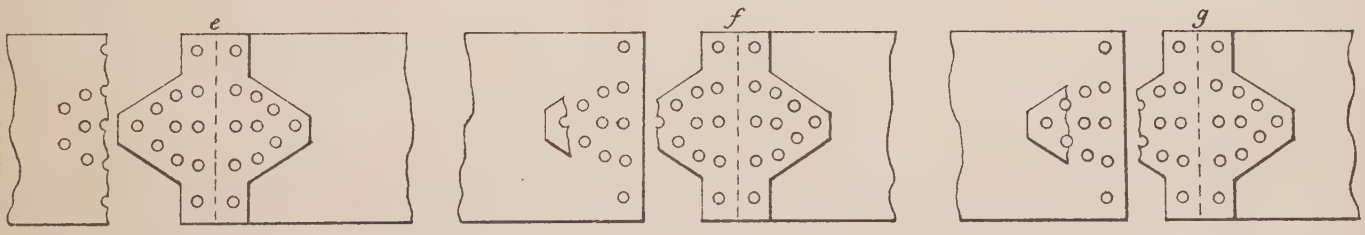


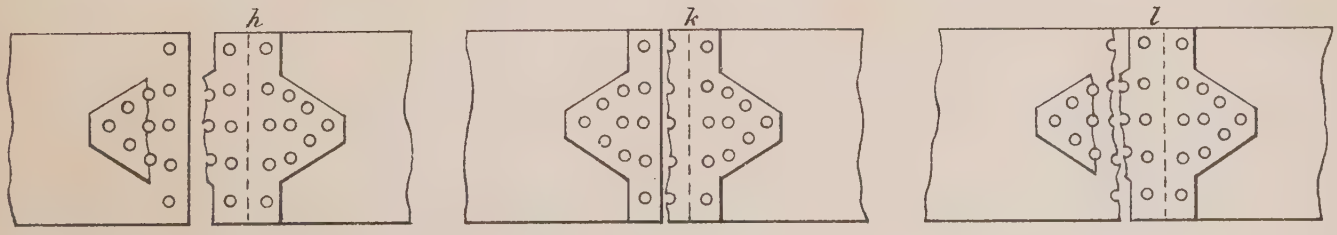
FIG. 5




a
24 inches
1"
5/8"
double butt straps
each 9/16"


b
c
d


e
f
g


h
k
l

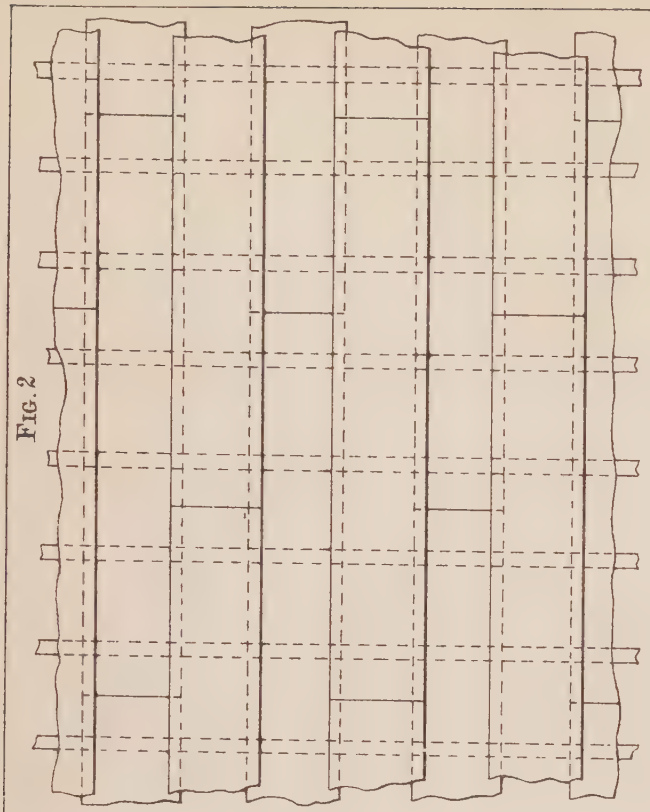


Fig. 2

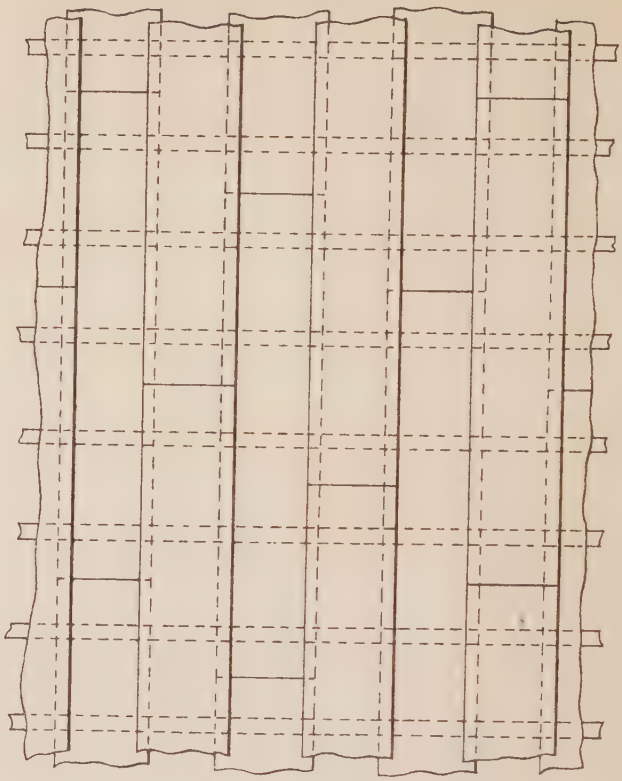


Fig. 4

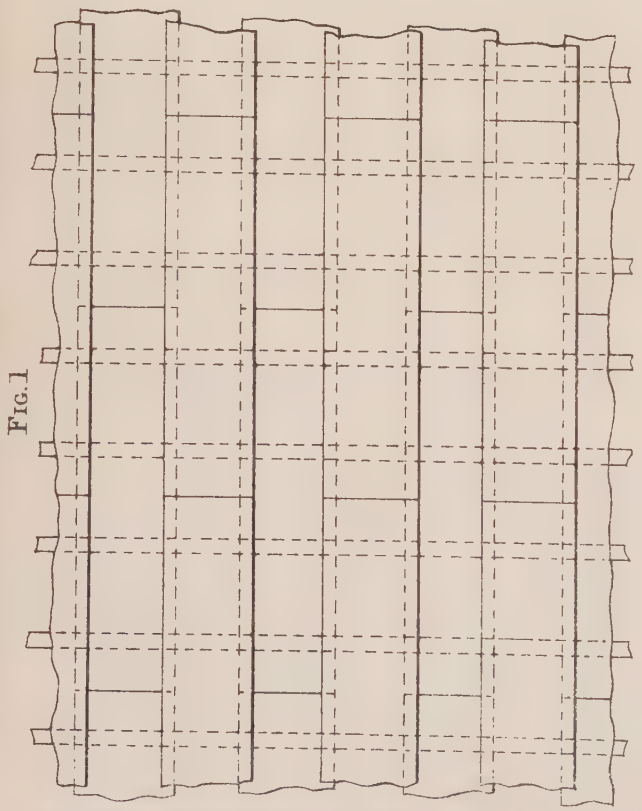


Fig. 1

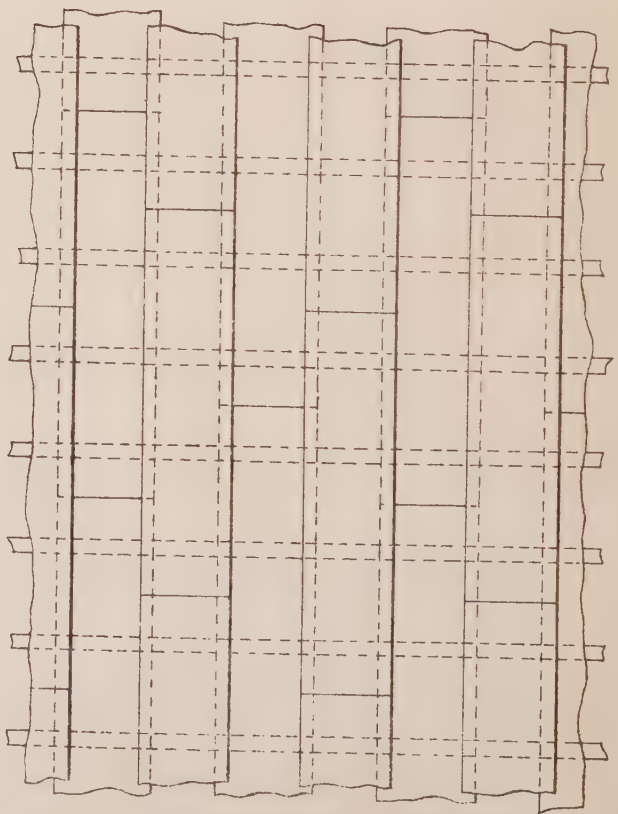


Fig. 3

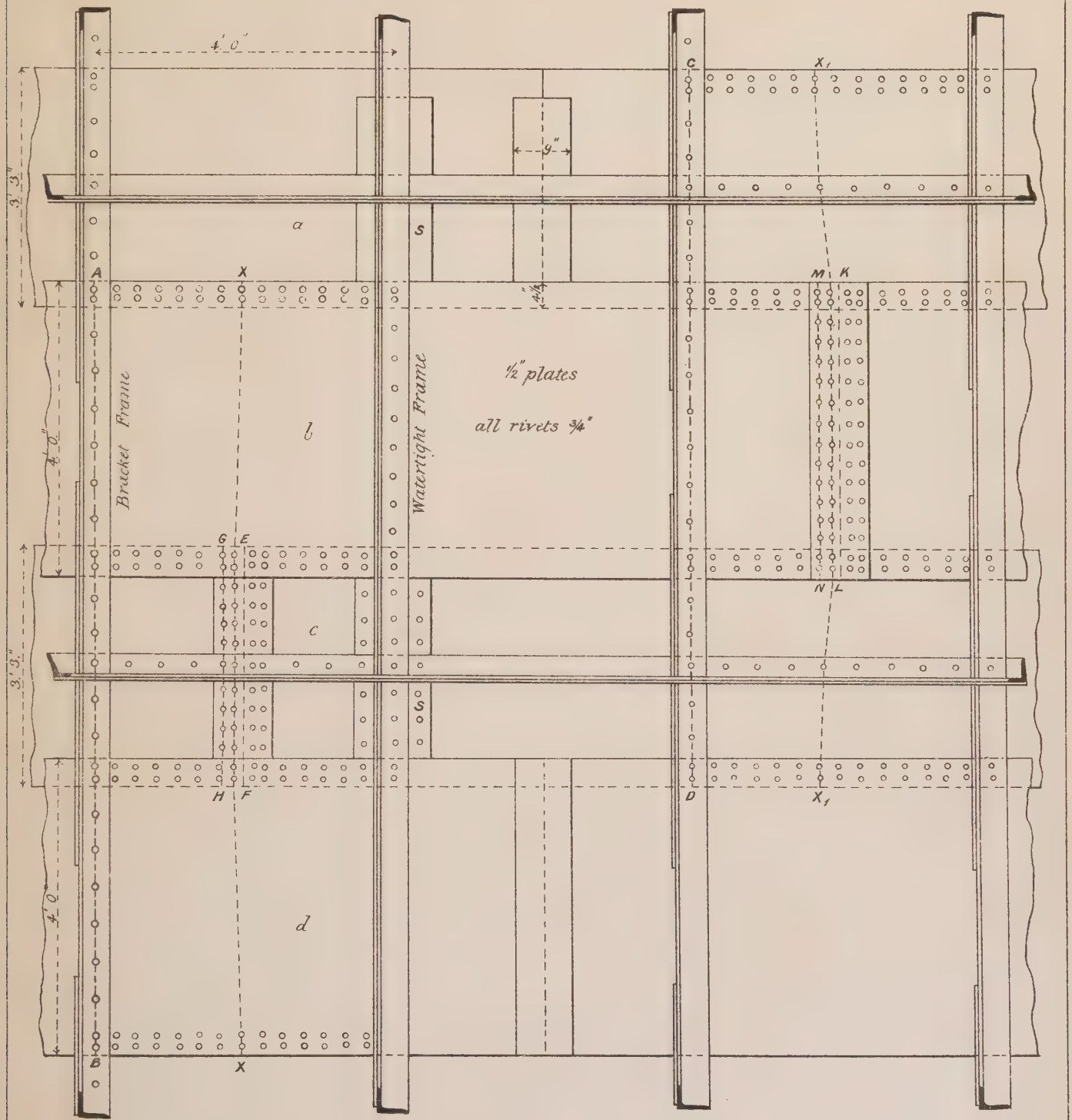

4' 0"
3' 3"
4' 0"
3' 3"
4' 0"
9"
4½"
a
b
c
d
S
S
A
X
G
E
H
F
B
X
C
X1
M
K
N
L
D
X1
Bracket Frame
Watertight Frame
½" plates
all rivets ¾"

FIG. 1

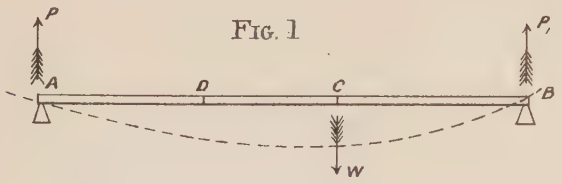


FIG. 2

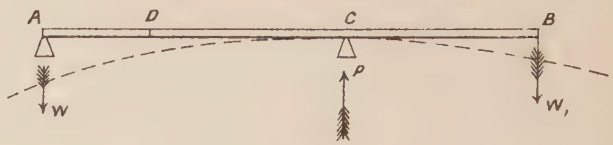


FIG. 3

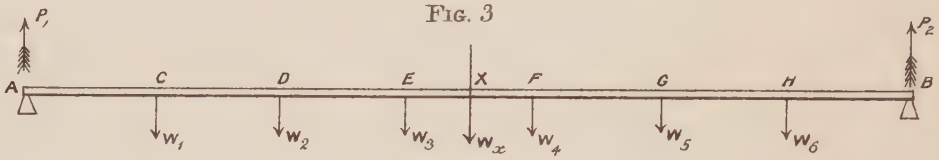
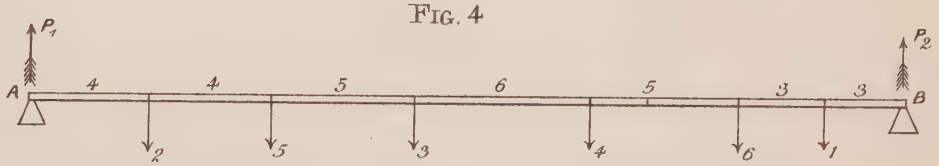


FIG. 4



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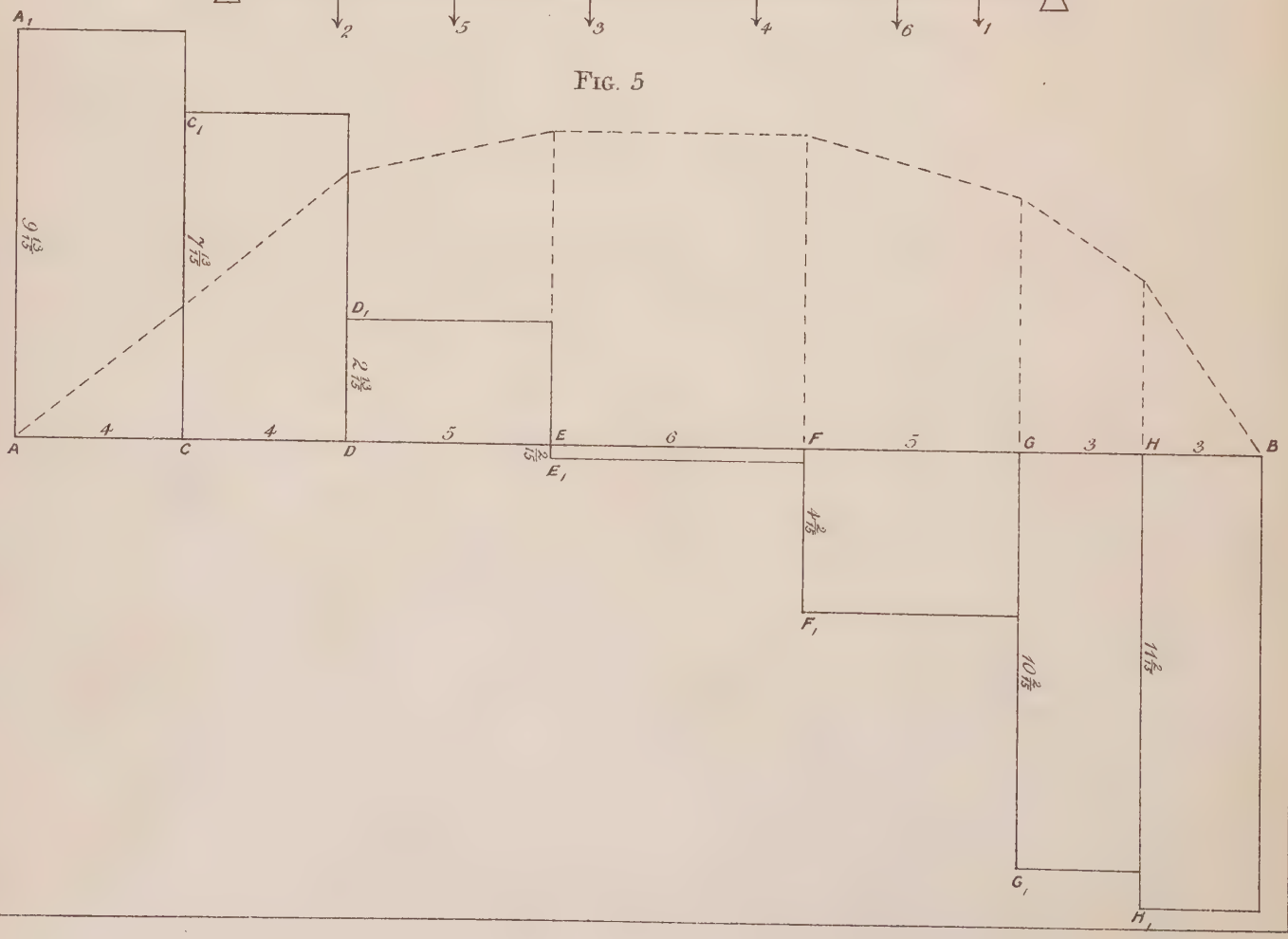
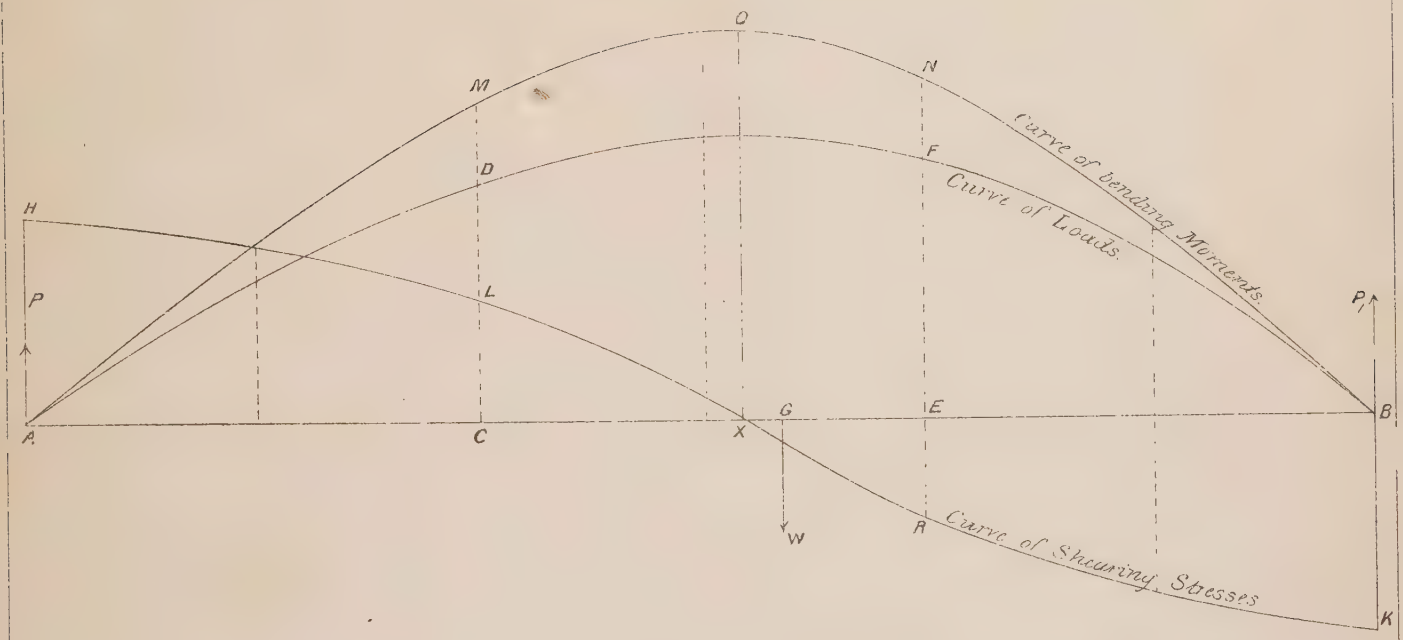


Fig. 1


O
M
N
D
F
H
L
P
P,
A
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X
G
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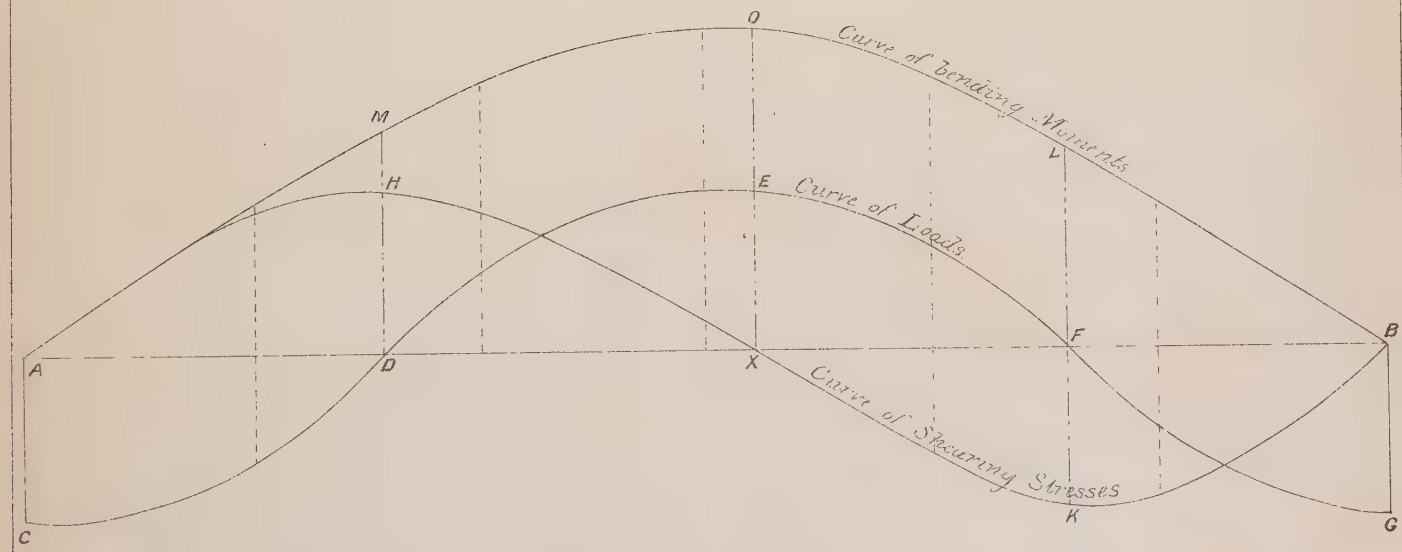
W
R
K
Curve of bending Moments.
Curve of Loads.
Curve of Shearing Stresses

Fig. 2


O
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Curve of bending Moments
Curve of Loads.
Curve of Shearing Stresses

Fig. 1

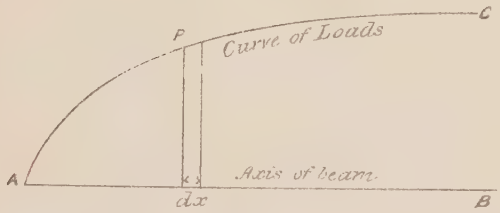


Fig. 2

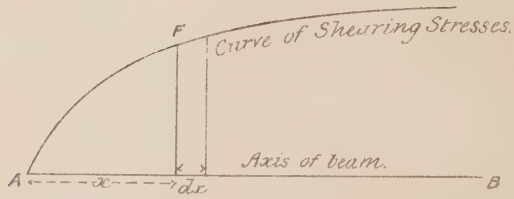


Fig. 3

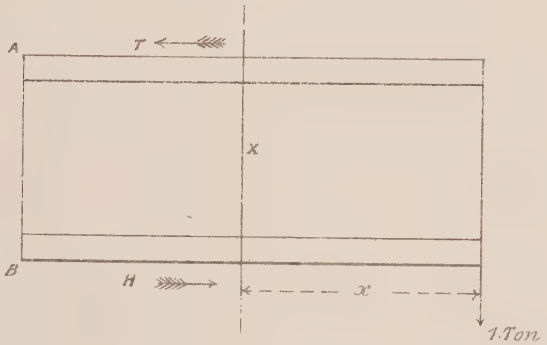


Fig. 4

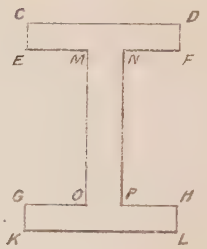


Fig. 5

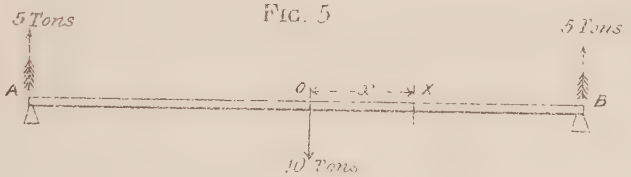


Fig. 6

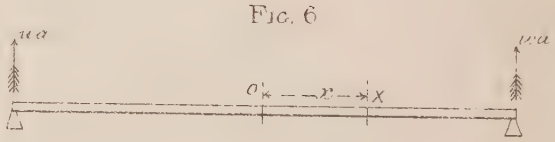
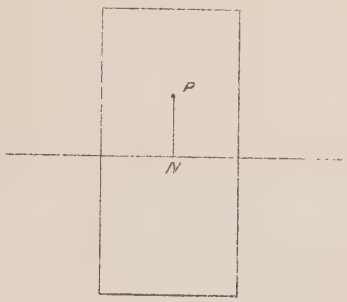


Fig. 7



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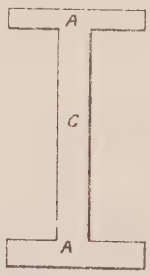


Fig. 9

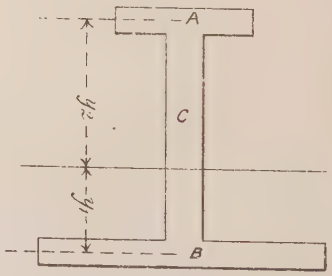


Fig. 1

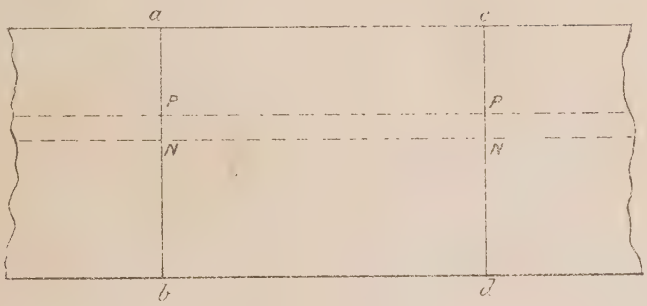


Fig. 2

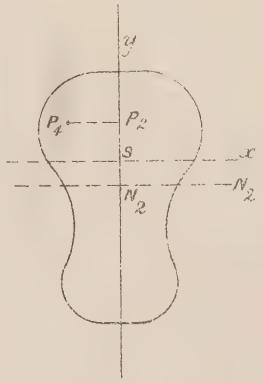


Fig. 3

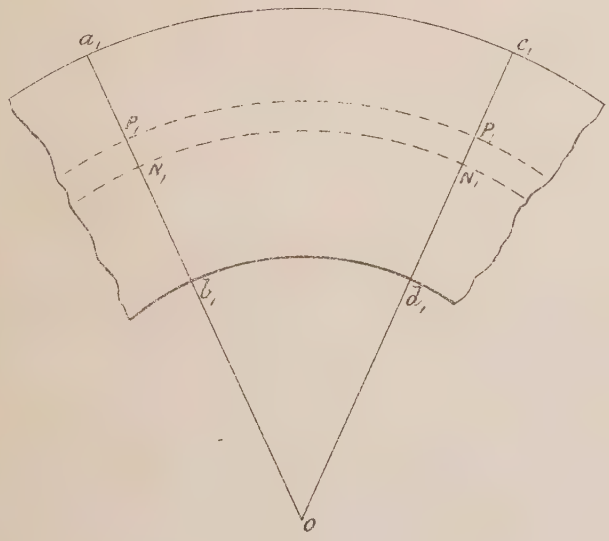


Fig. 4

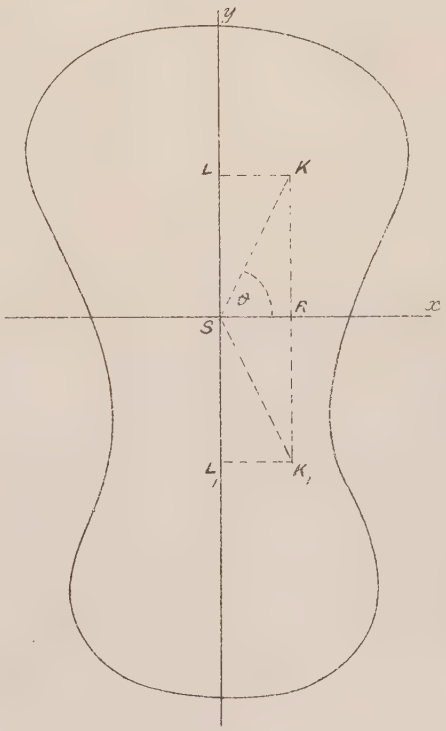


Fig. 1

Fig. 2

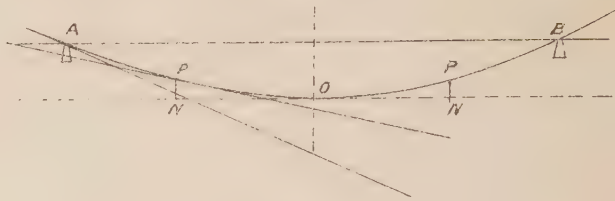


Fig. 3

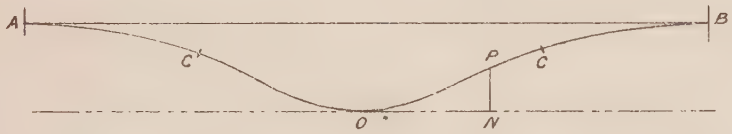


Fig. 4

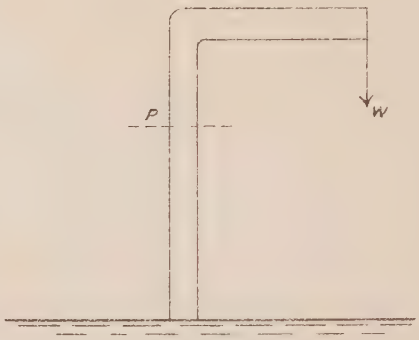


Fig. 5

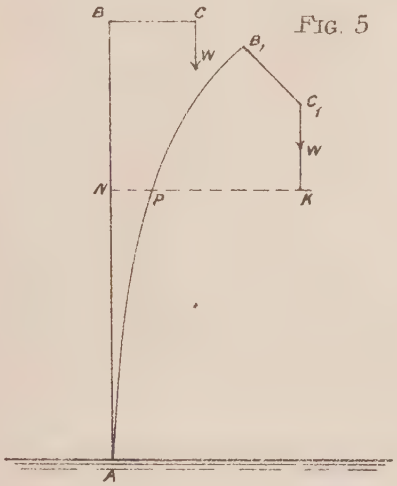


Fig. 6

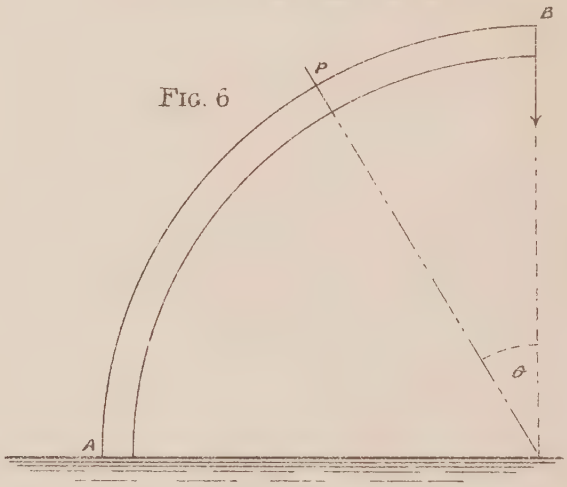


Fig. 7

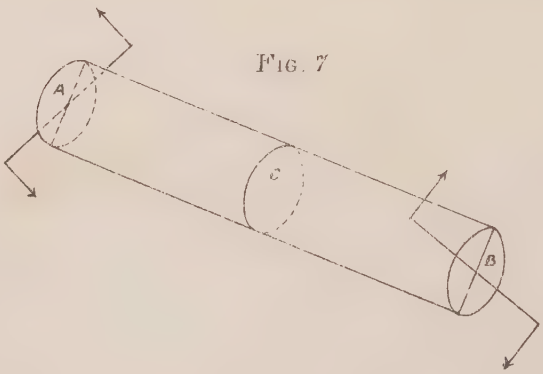


FIG. 1

"MINOTAUR" *Curves of weights and buoyancy*

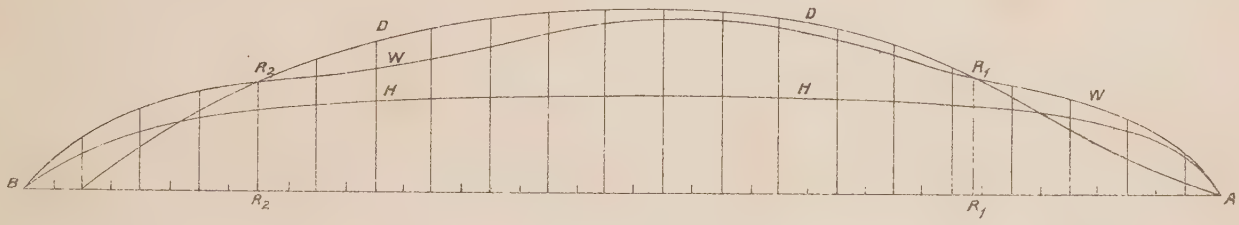


FIG. 2

"VICTORIA *and* ALBERT" *Curves of weights and buoyancy.*

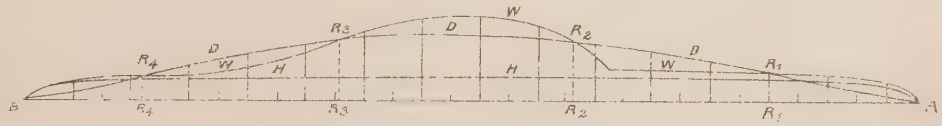


FIG. 3

"BELLEROPHON" *Curves of weights and buoyancy*

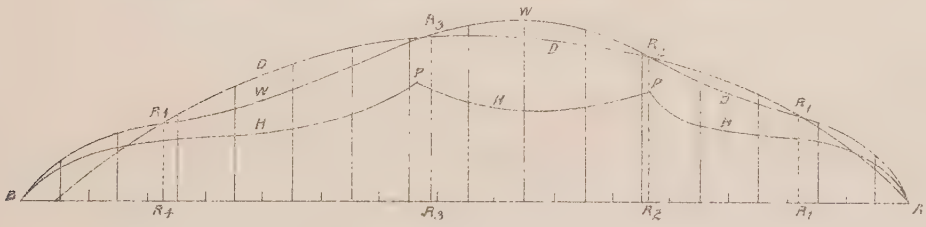
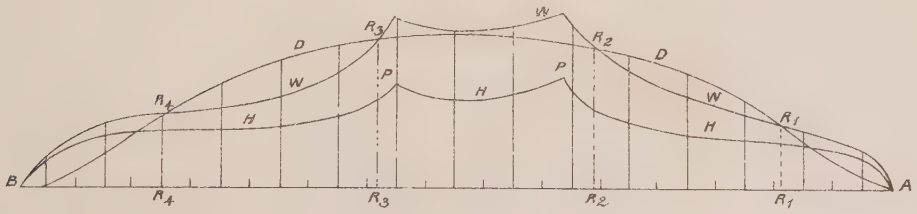


FIG. 4

"AUDACIOUS" *Curves of weights and buoyancy*



Curves of LOADS, SHEARING STRESSES *and* BENDING MOMENTS IN STILL WATER.

FIG. 1 "MINOTAUR"

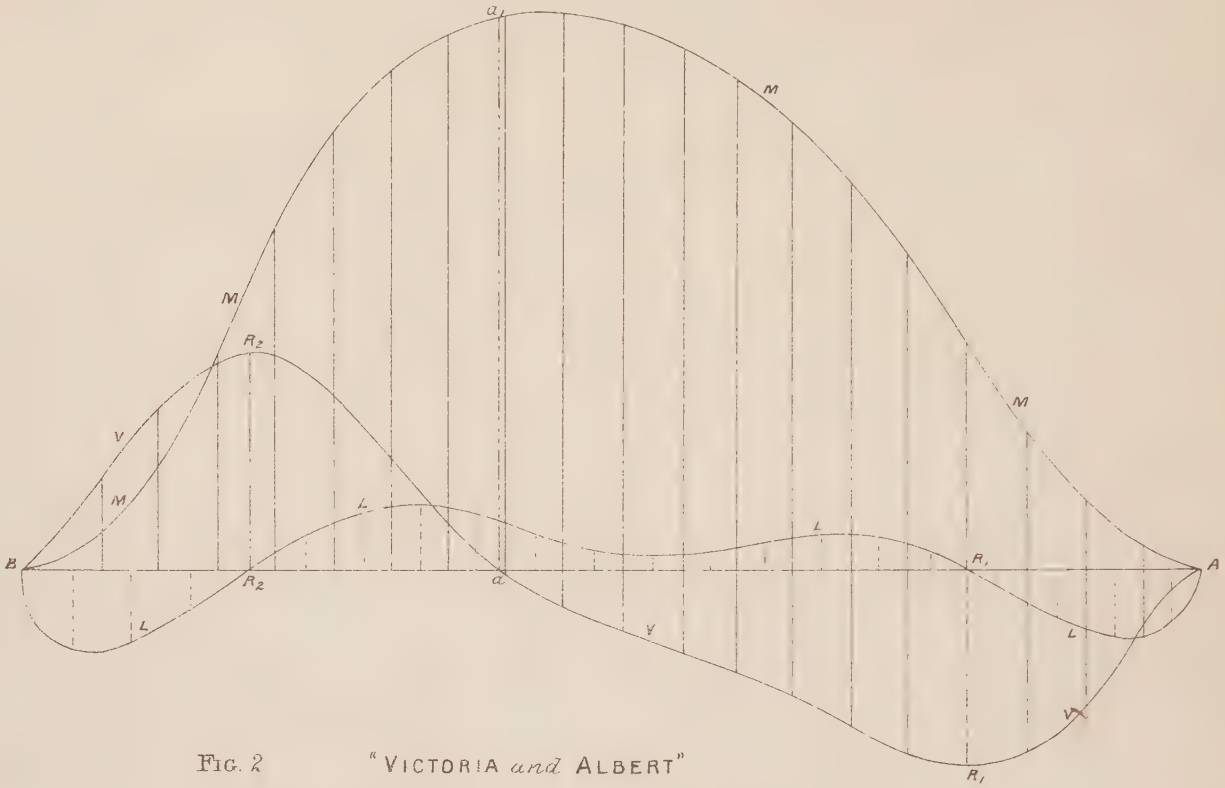


FIG. 2 "VICTORIA *and* ALBERT"

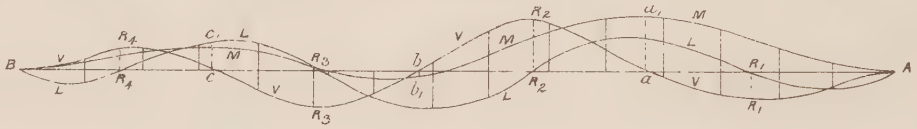


FIG. 3 "BELLEROPHON"

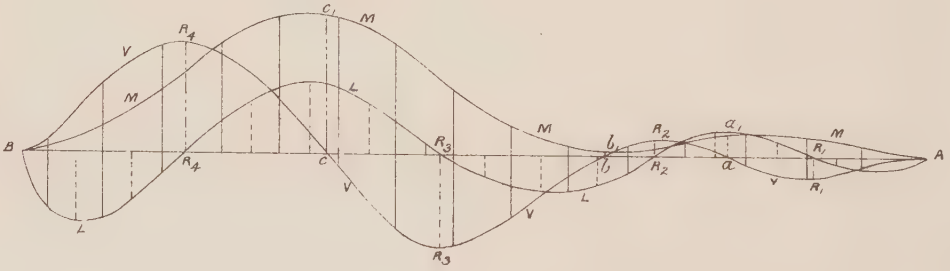


FIG. 4 "AUDACIOUS"

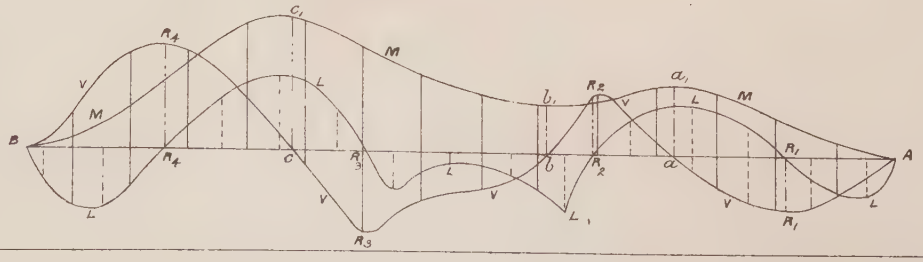


FIG. 1 "MINOTAUR" on crest of Wave 400 ft × 25 ft.

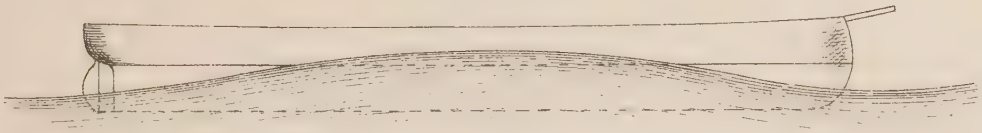


FIG. 2 "MINOTAUR" in hollow of Wave 400 ft × 25 ft

FIG. 3

"MINOTAUR" Curves of weight and buoyancy.

References to Figs 3 & 4
FF = Curve of buoy.y for crest
GG - —"—"— hollow
Scale 3 in along AB = 400 ft.
—"— 3 sq in = 16000 tons
Wave = 300 ft × 20 ft
in Fig 4, 5 & 6

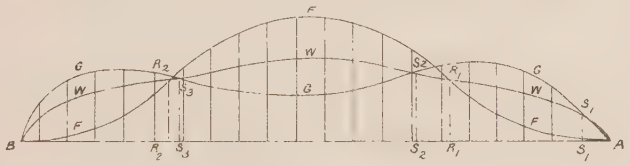


FIG. 4 "BELLEROPHON" Curves of weight and buoyancy.

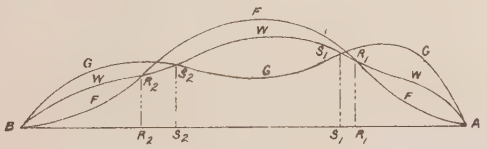


FIG. 6. "BELLEROPHON" as Fig 5. for hollow.

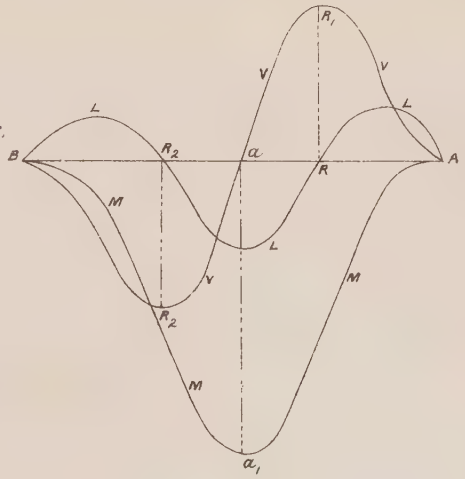


FIG. 5 "BELLEROPHON" Curves of Loads, Shearing Stresses, and bending Moments for crest of Wave.

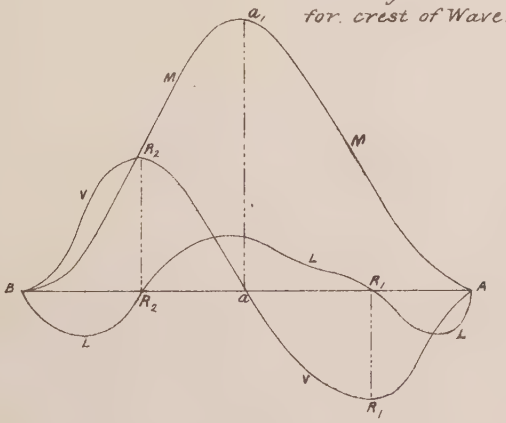


Fig. 1 "MINOTAUR" Curves of Loads, bending Moments and Shearing Stresses, when on crest of wave 400ft × 25ft.

Scale 3 Sq inches = 8000 tons
Scale along AB 3in = 400ft.
of VV 1in = 800 tons
" " MM 1in = 32000 ft tons

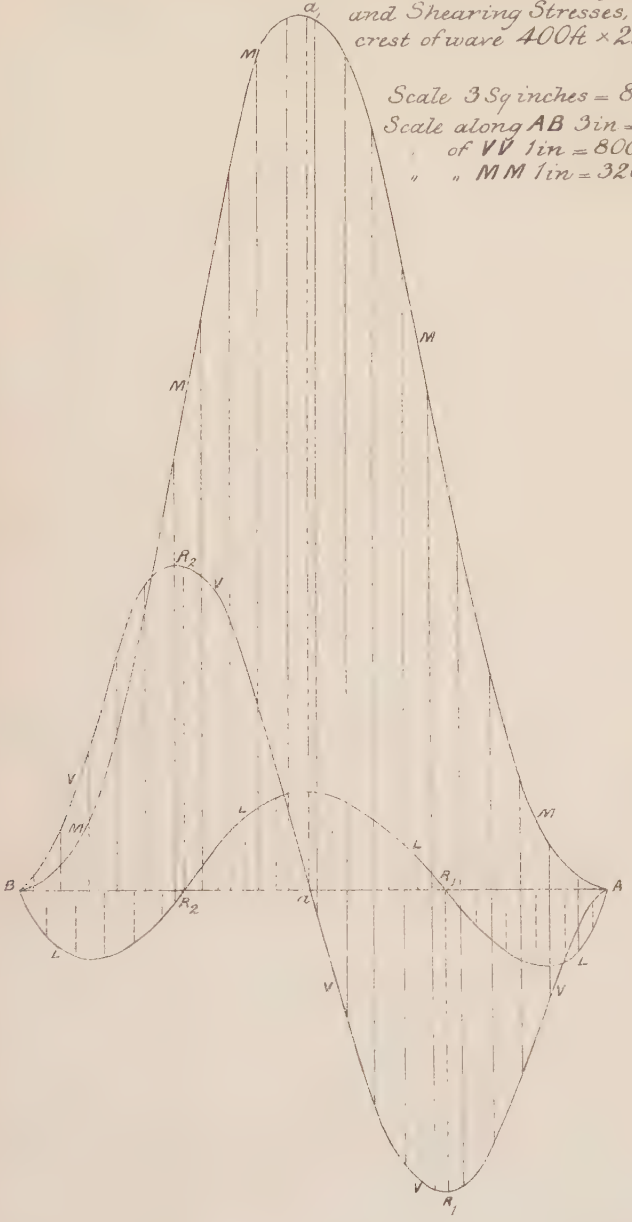


Fig. 2 "MINOTAUR" Curves when in R1 hollow of wave.

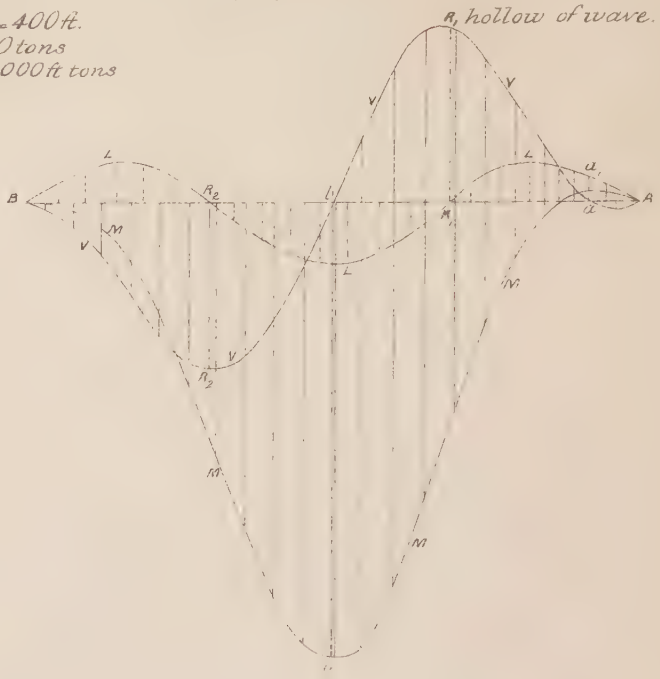


Fig. 3

"VICTORIA and ALBERT" Curves of wt & buoyy. See Figs 3 & 4 Plate XLVII

Fig. 4

"VICTORIA and ALBERT" Curves as in Fig 1. wave 300ft × 20ft.

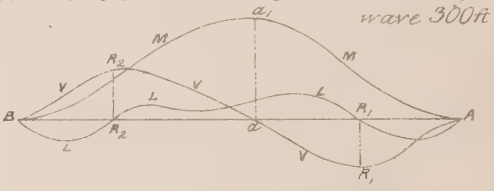
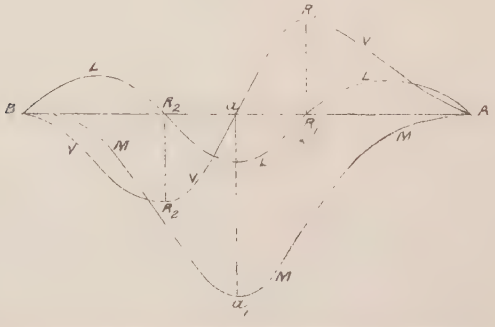


Fig. 5

"VICTORIA and ALBERT" Curves as in Fig 2.



Midship Section of a 3 decked Merchant Ship showing position of the Neutral Axis.

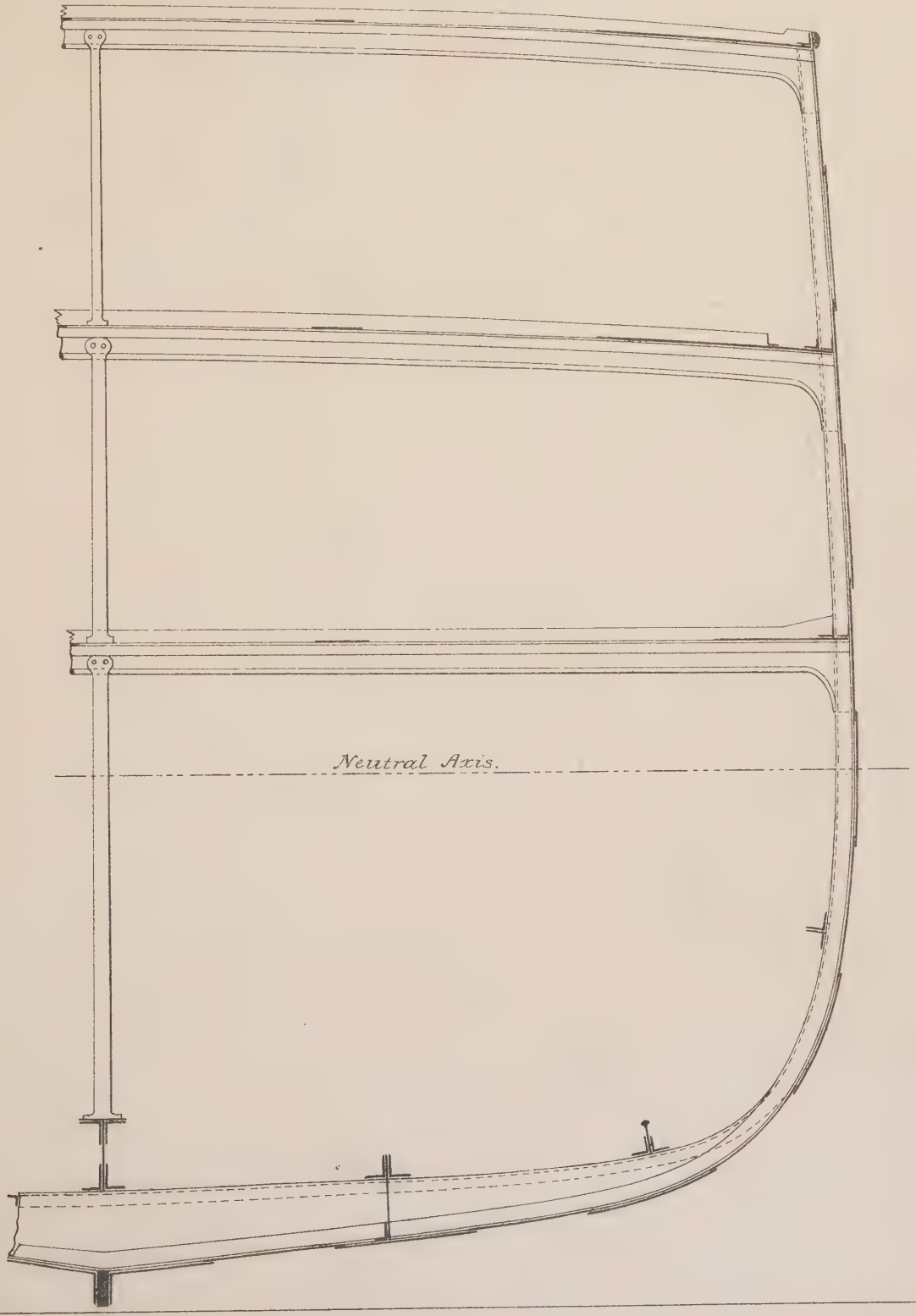


Plate I.

Equivalent Girder of an Unarmoured War Ship.

Scale of Vertical Measurements 1/4 in = 1 Foot.

" " Horiz.l Measurements 1/2 in = 1 Foot.

Moment of Inertia = 113273

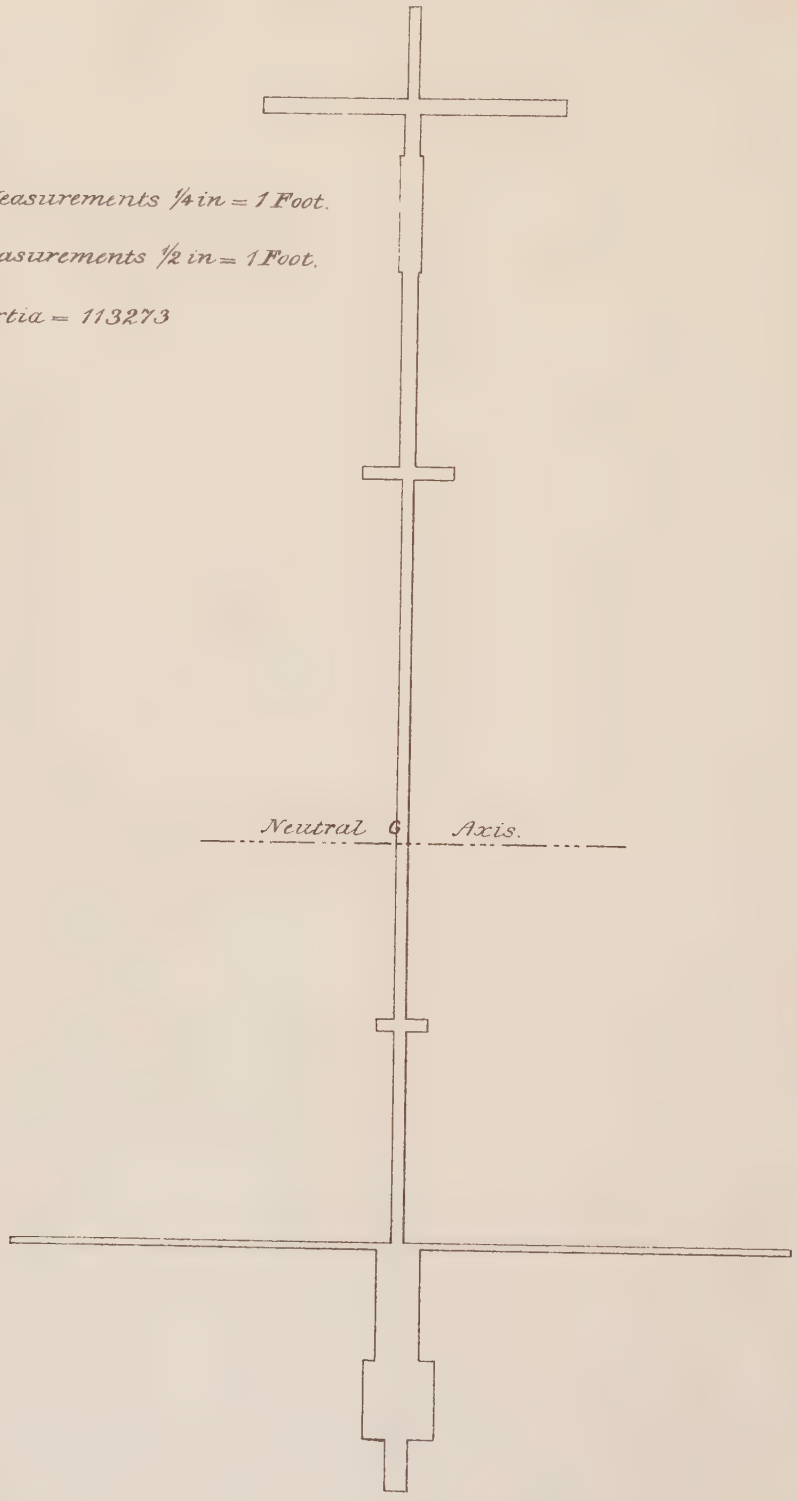


Fig. 1

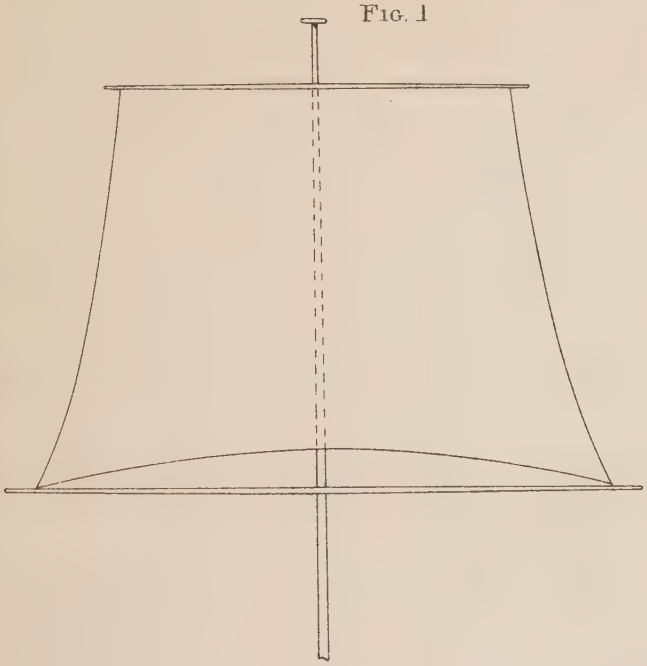


Fig. 2

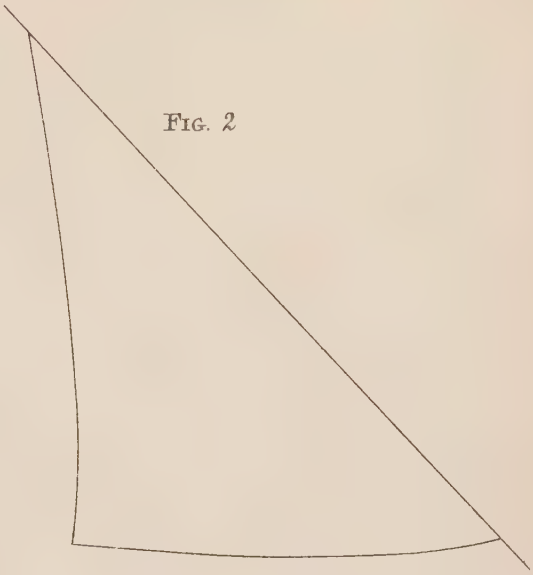


Fig. 5

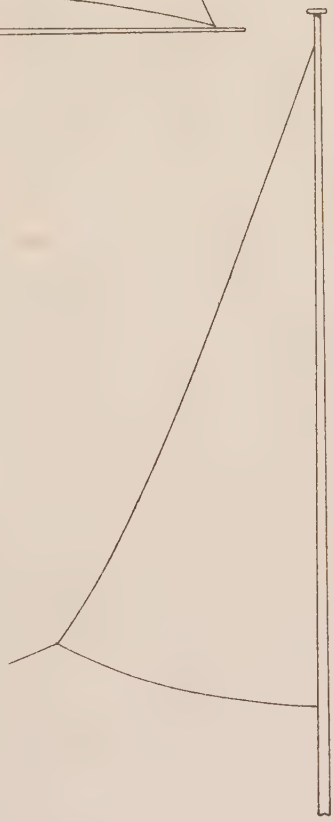


Fig. 3

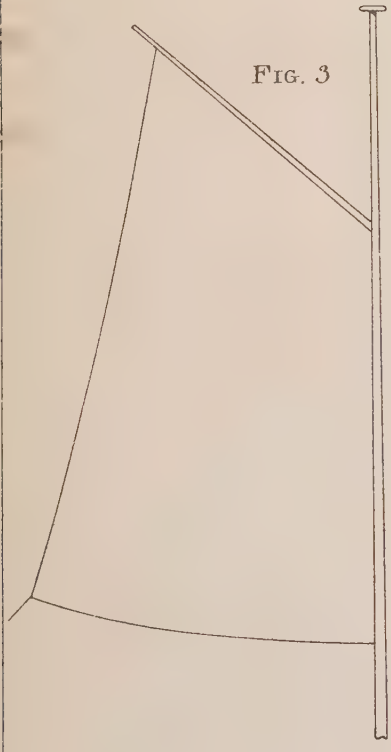


Fig. 4

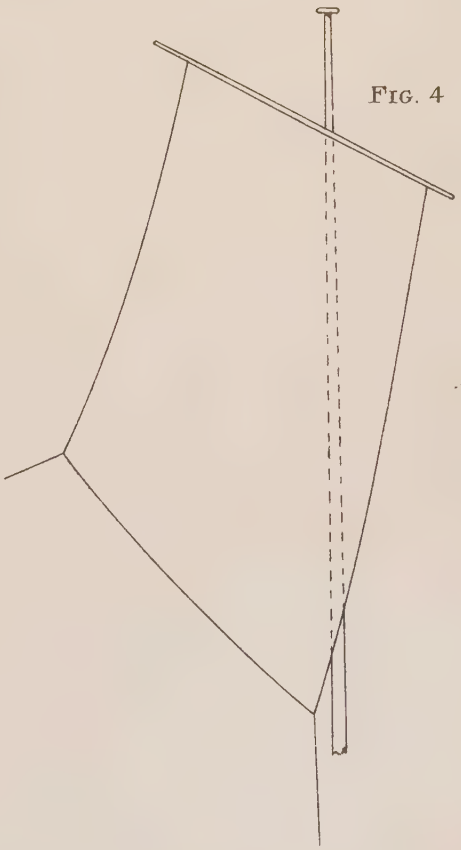


Fig. 1

Cutter

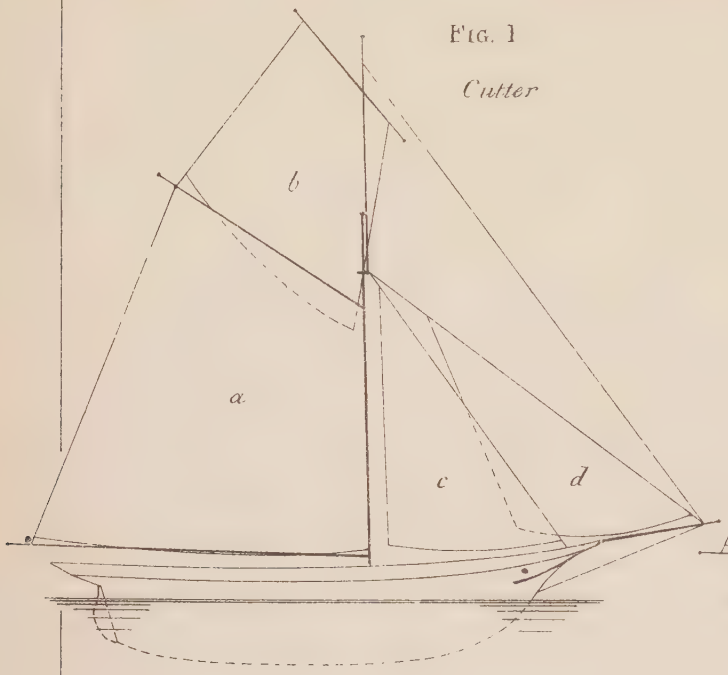


Fig. 3

Brigantine

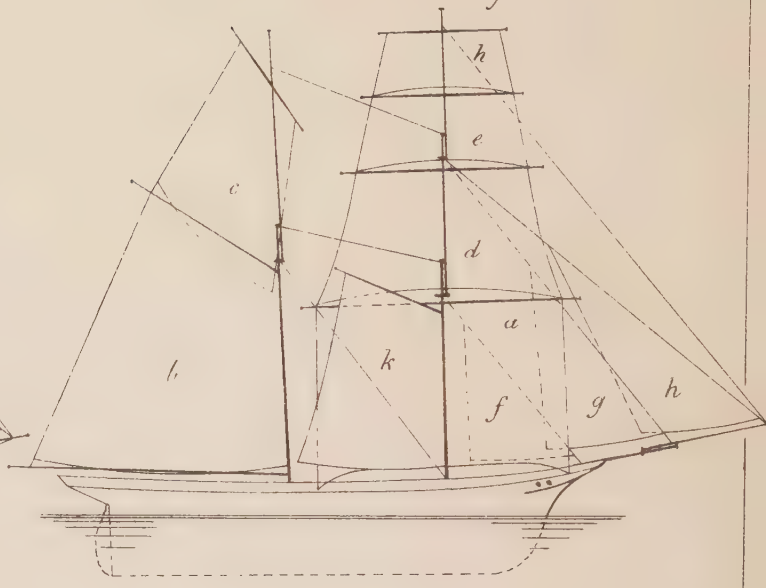
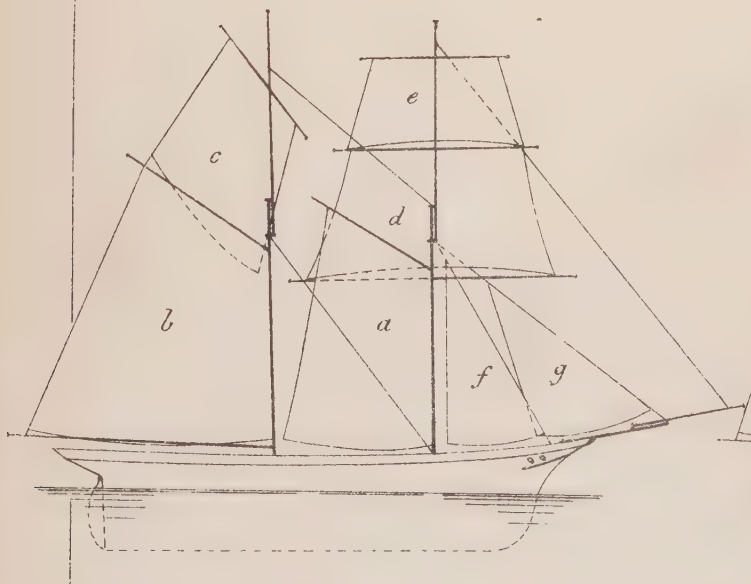


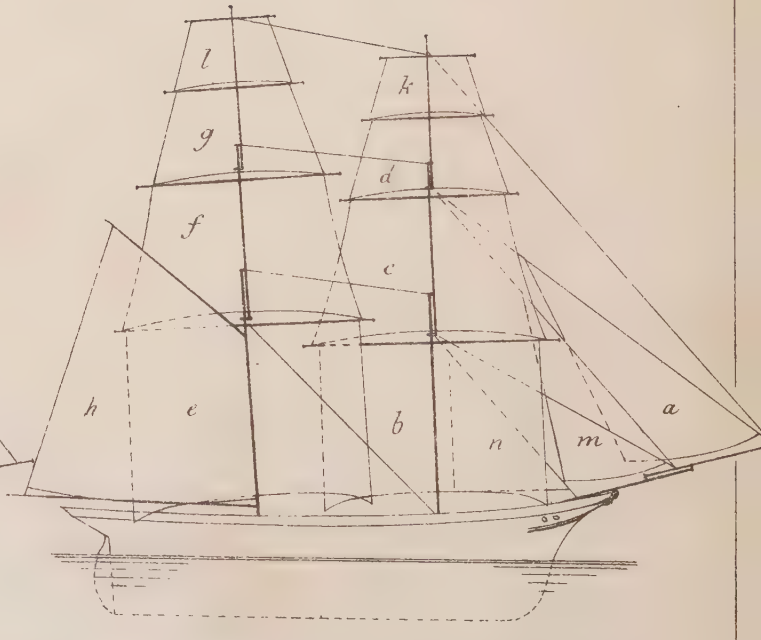
Fig. 4

Fig. 2

Schooner



Brig.



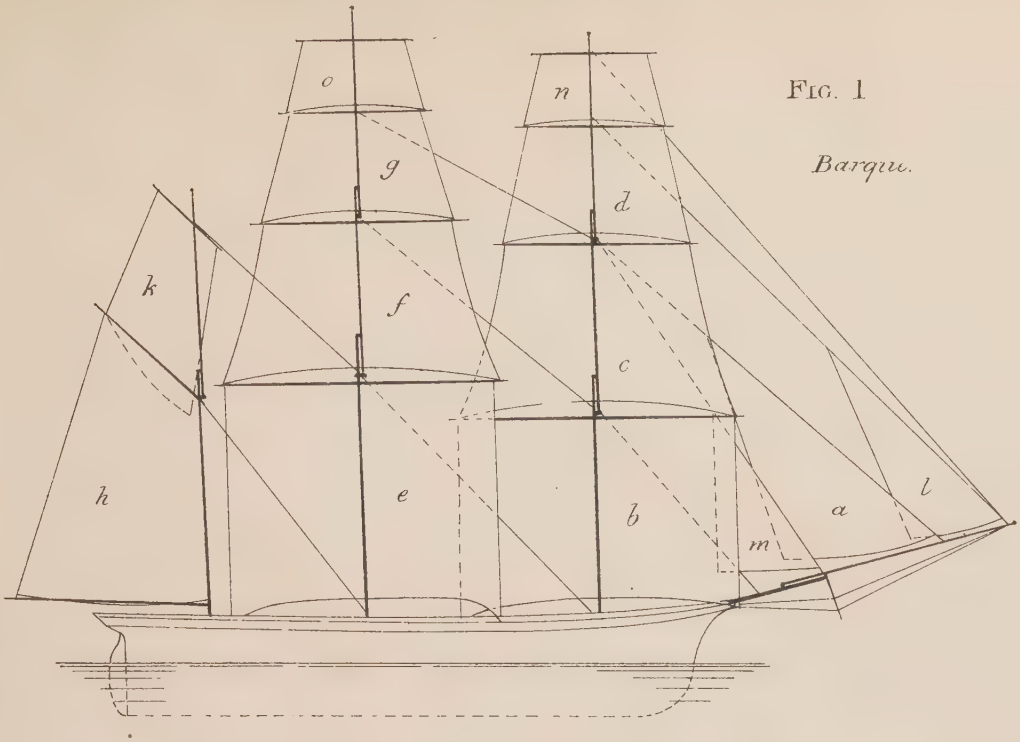


FIG. 1

Barque.

FIG. 2

Clipper Ship.

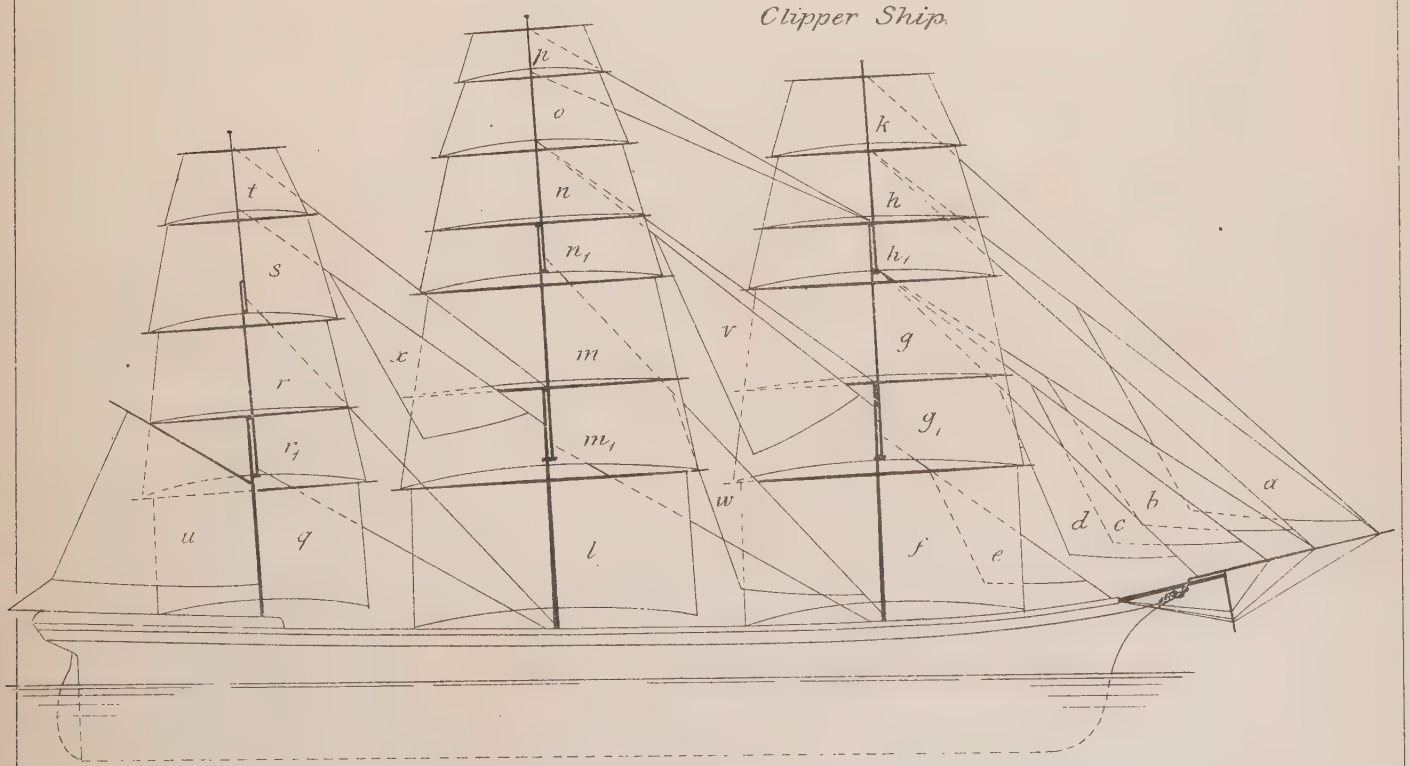


Fig. 1

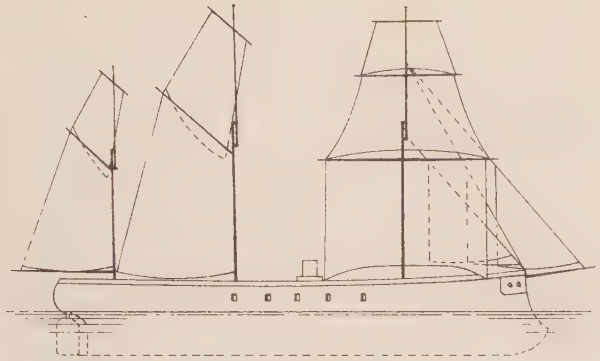
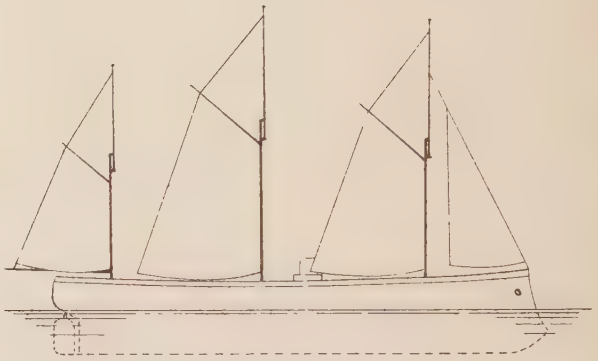


Fig. 2



References to Fig 3

Total Area of Sail	46977 Sq. ft.
Total Area of Plain Sail	28800 "
Area of Plain Sail per 1 Ton of Displ.mt	3·35 "
Area of Plain Sail per 1 Sq. ft of Midsl. Sec.n	22·1 "
Area of Plain Sail per 1 ton of (Displ.mt)$^{2/3}$	68·65 "
Draught of Water Forward	22'.6"
Draught of Water Aft	26'.6"
Corresponding Displacement	8592 Tons
Corresponding Area of Midl. Sec.n	1902 Sq ft.

Fig. 3

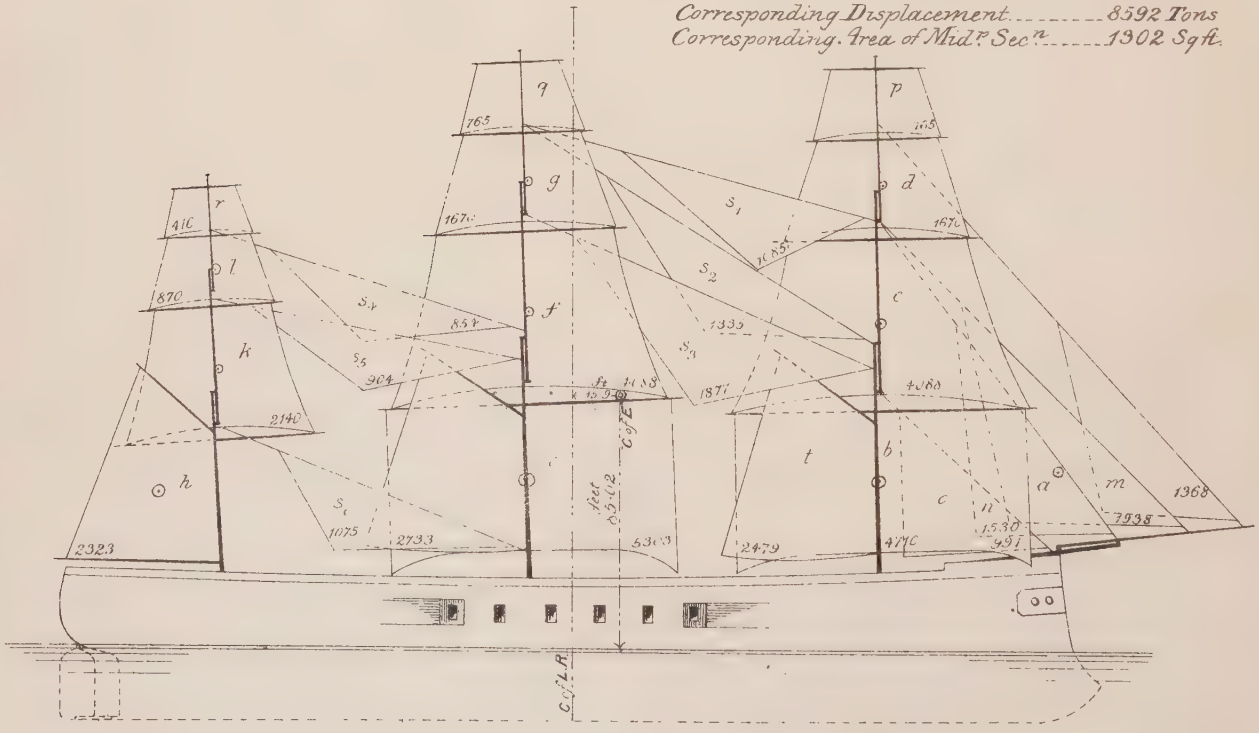


Fig. 1

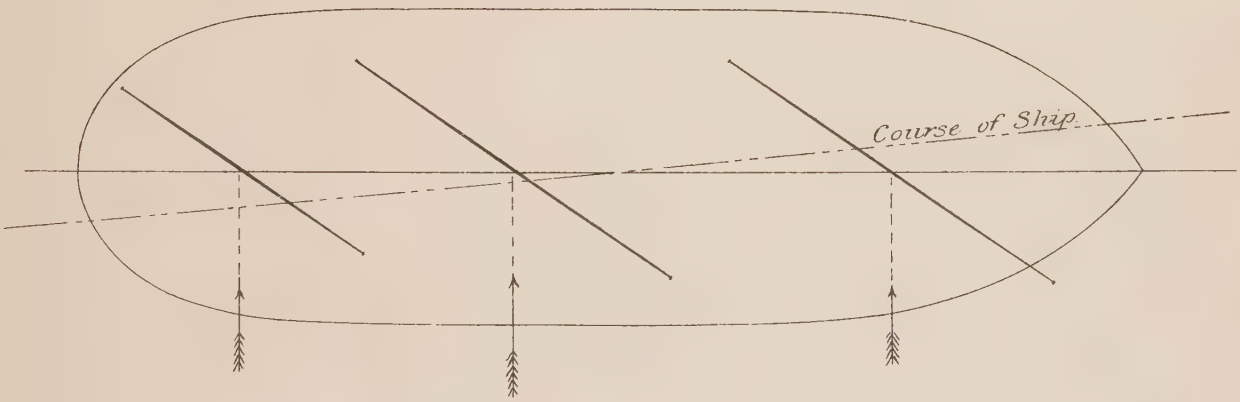


Fig. 2

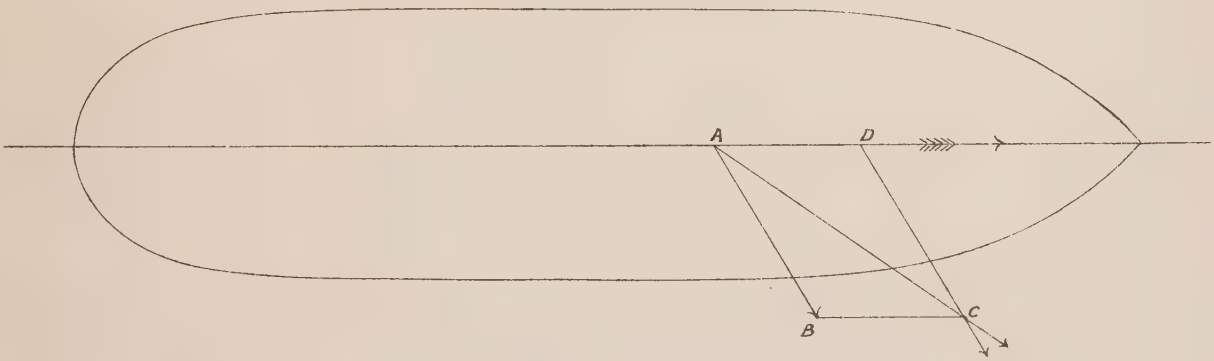


Fig. 3

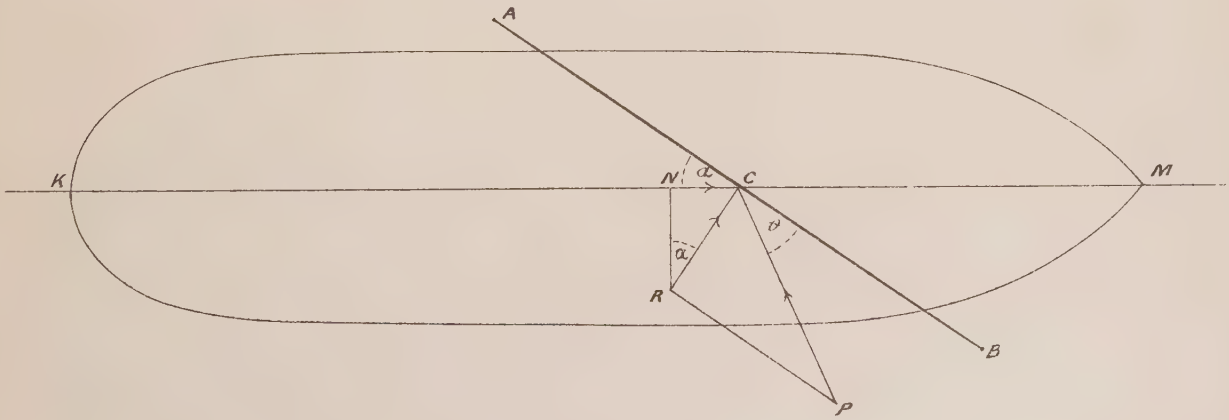
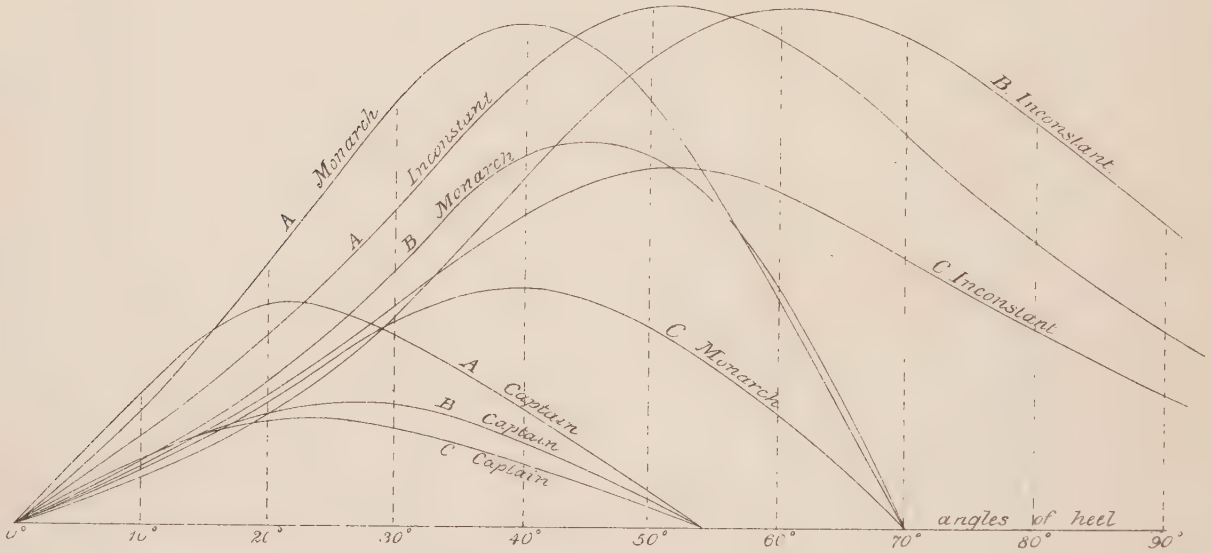


FIG. 1



NOTE. *The curves marked A have their ordinates proportional to the absolute righting moment at the different angles of heel.*

The curves marked B have their ordinates proportional to the absolute righting moment, divided by the moment of the wind pressure on the sail, at the different angles of heel.

The curves marked C have their ordinates proportional to the horizontal distance between the centres of buoyancy and gravity at the different angles of heel.

FIG. 2

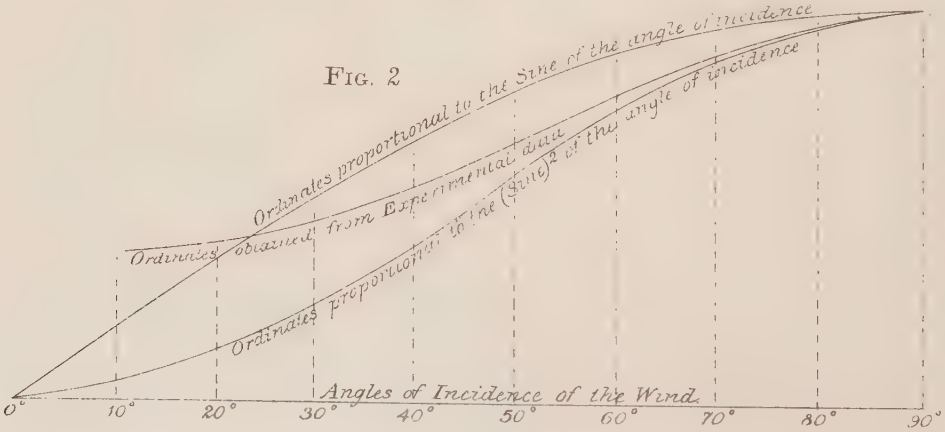


FIG 1

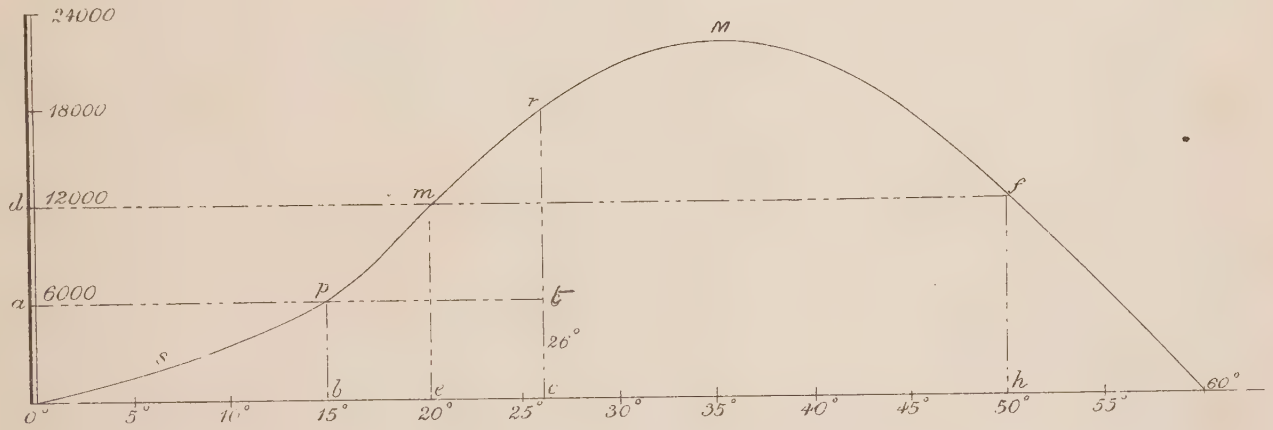

24000
18000
12000
6000
d
a
M
r
m
f
p
s
b
e
c
26°
h
60°
0°
5°
10°
15°
20°
25°
30°
35°
40°
45°
50°
55°

FIG. 2

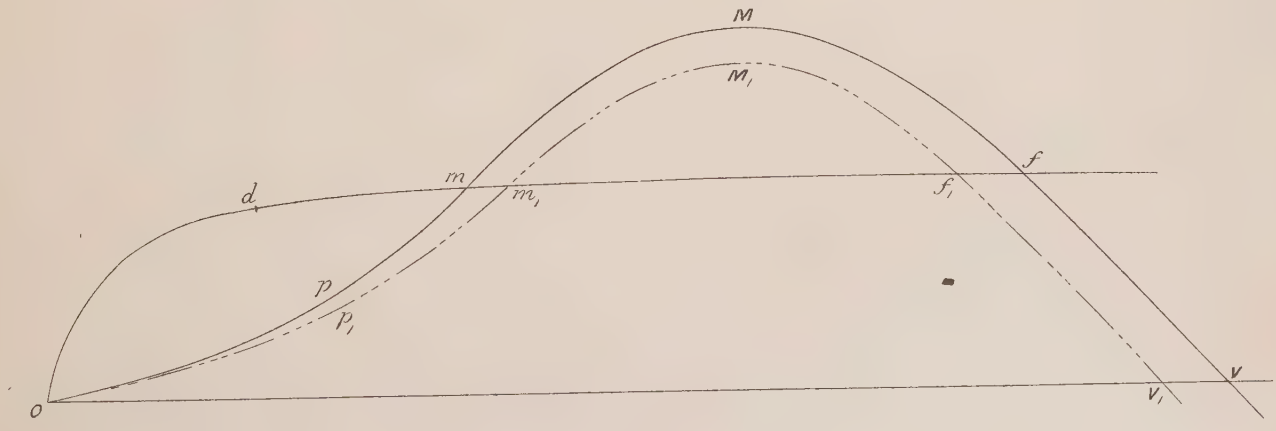

M
M1
m
m1
d
f
f1
p
p1
o
v
v1

FIG. 1

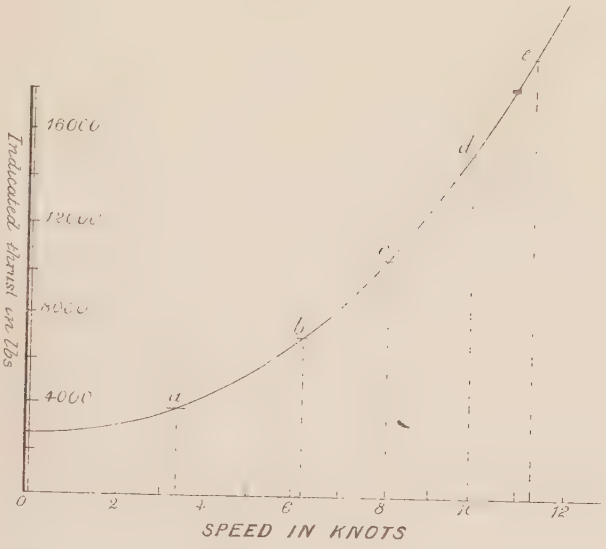
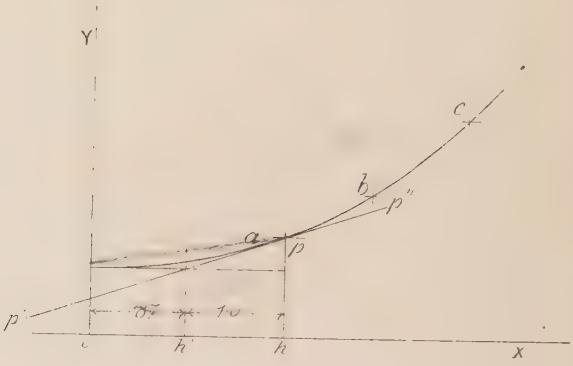


FIG. 2



Scales of Ordinates in Fig 3

Curve of Ind.ª Thrust :	¼ inch = 4000 lbs
Curve of Ind.ª H.P. :	¼ inch = 200 horse power
Curve of Coeff.t $\frac{AV^3}{I.H.P.}$	¼ inch = 200 lbs
Curve of Slip.	¼ inch = 1 knot
Zero Line of &c. &c	¼ inch = 4000 lbs

N.B. By A is meant "area of Immersed Mid.ᵖ Sec.ⁿ

FIG. 3

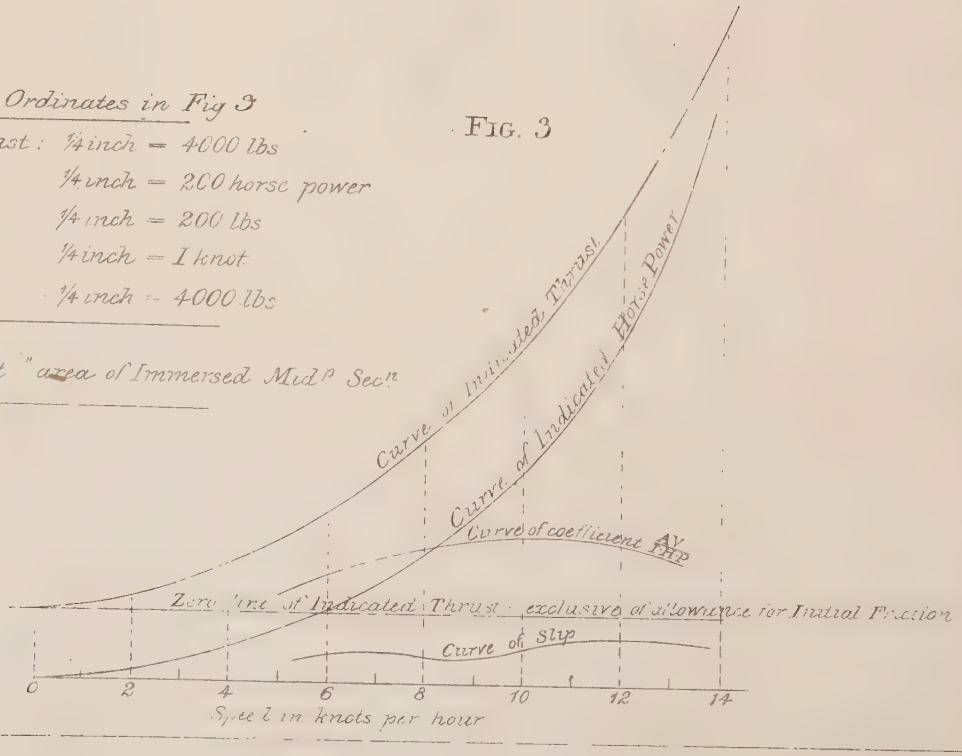


FIG. 1

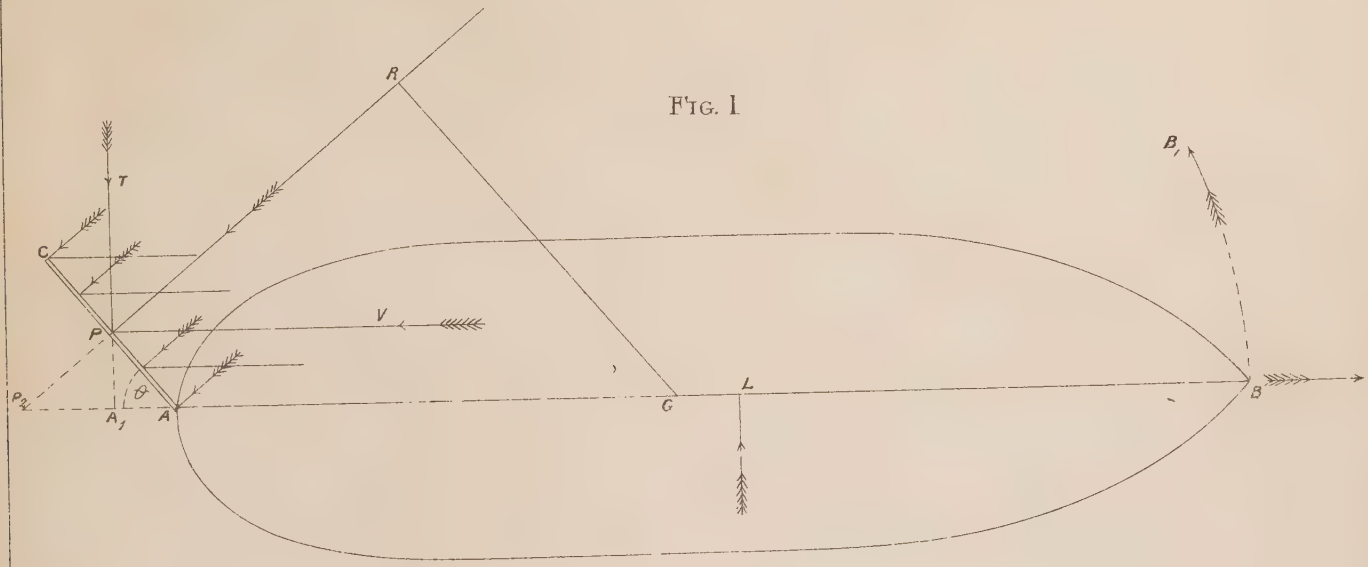


FIG. 2

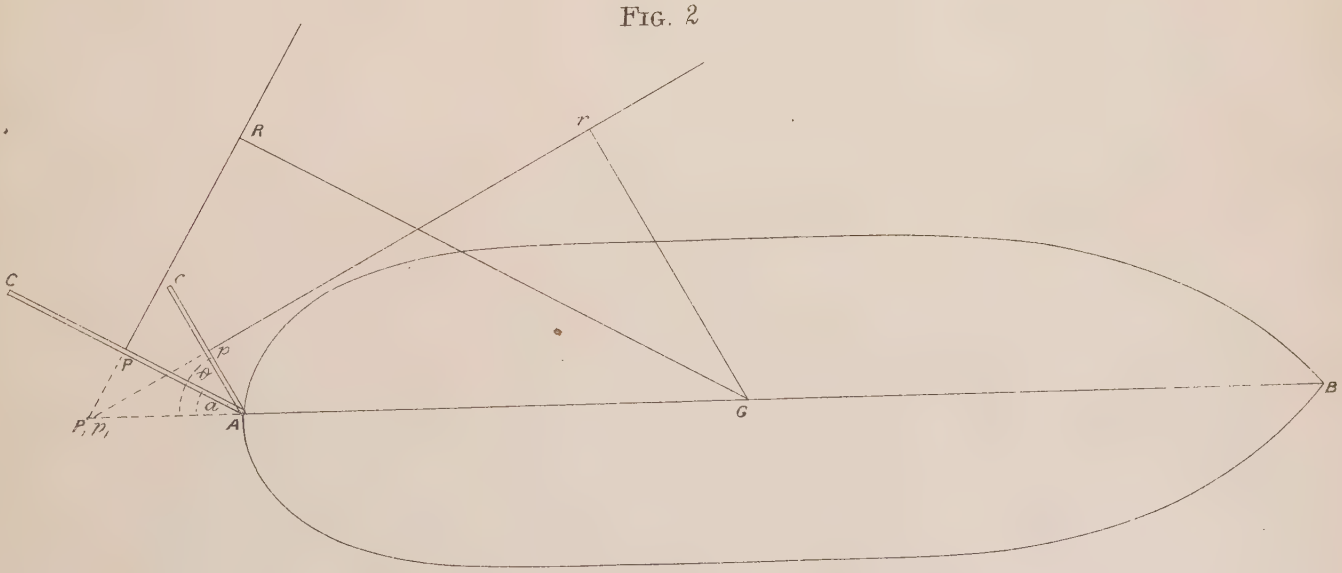


Plate LX

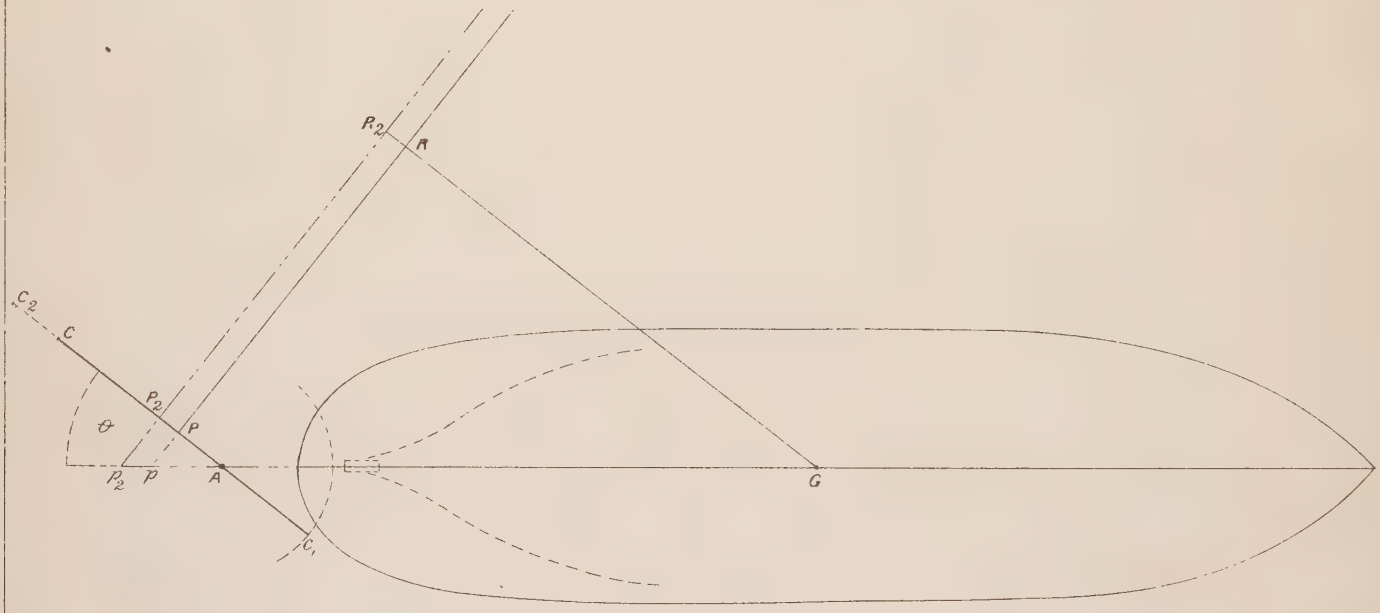


Plate LX

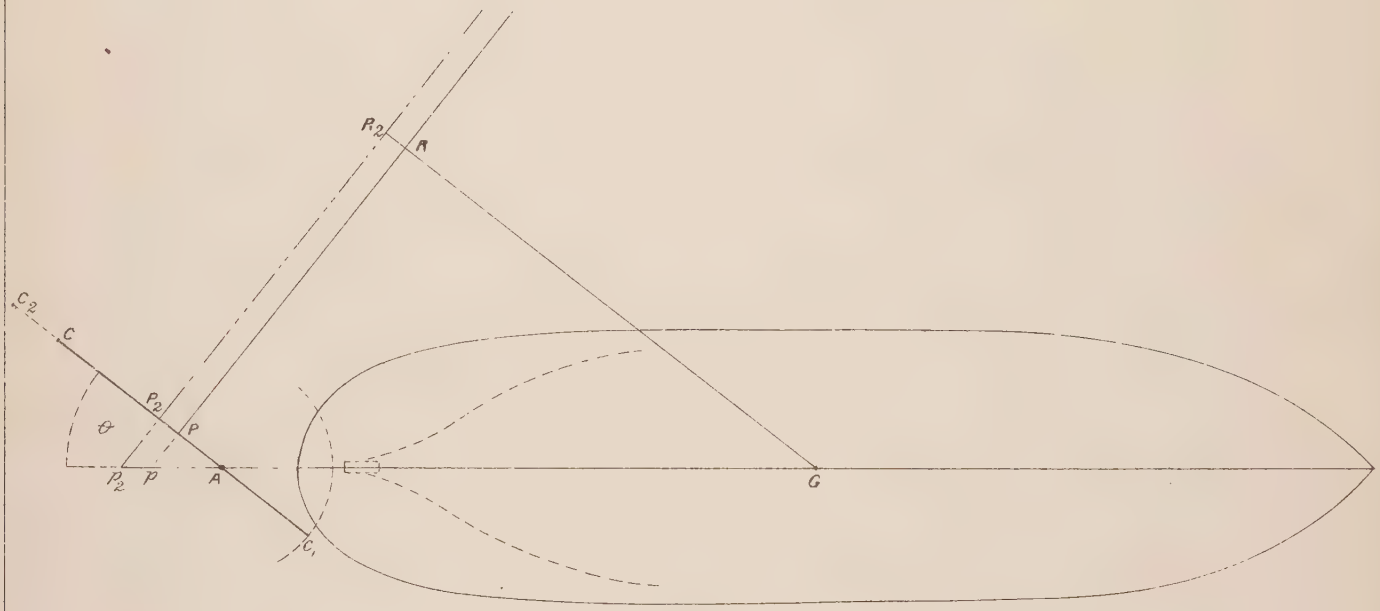


TABLE II.

SPECIMEN CALCULATION FOR SURFACE STATICAL STABILITY.

PRELIMINARY TABLE.

UPRIGHT WATER PLANE.

IMMERSED WEDGE.

Numbers of Ordinates.	Ordinates.	Squares of Ordinates.	Simpson's Multipliers.	Functions of Squares.	Number of Intervals from No. 1.	Longitudinal Moments.	Cubes of Ordinates.	Simpson's Multipliers.	Functions of Cubes of Ordinates.
1	·8	·6	$\frac{1}{3}$	·3	0	0	·5	$\frac{1}{2}$	·2
$1\frac{1}{2}$	4·9	24·0	2	48·0	$\frac{1}{2}$	24·0	117·6	2	235·2
2	8·9	79·2	$1\frac{1}{2}$	118·8	1	118·8	705·0	$1\frac{1}{2}$	1057·5
3	16·2	262·4	4	1049·6	2	2099·2	4251·5	4	17006·0
4	21·2	449·4	2	898·8	3	2696·4	9528·1	2	19056·2
5	23·6	557·0	4	2228·0	4	8912·0	13144·3	4	52577·2
6	24·5	600·3	2	1200·6	5	6003·0	14706·1	2	29412·2
7	24·5	600·3	4	2401·2	6	14407·2	14706·1	4	58824·4
8	24·5	600·3	2	1200·6	7	8404·2	14706·1	2	29412·2
9	24·5	600·3	4	2401·2	8	19209·6	14706·1	4	58824·4
10	24·4	595·4	2	1190·8	9	10717·2	14526·8	2	29053·6
11	23·4	547·6	4	2190·4	10	21904·0	12813·0	4	51252·0
12	19·5	380·3	$1\frac{1}{2}$	570·4	11	6274·4	7414·9	$1\frac{1}{2}$	11122·3
$12\frac{1}{2}$	15·0	225·0	2	450·0	$11\frac{1}{2}$	5175·0	3375·0	2	6750·0
13	1·5	2·3	$\frac{1}{2}$	1·1	12	13·2	3·4	$\frac{1}{3}$	1·7
				15949·8		105958·2			364585·1

EMERGED WEDGE.

Numbers of Ordinates.	Ordinates.	Squares of Ordinates.	Simpson's Multipliers.	Functions of Squares.	Number of Intervals from No. 1.	Longitudinal Moments.	Cubes of Ordinates.	Simpson's Multipliers.	Functions of Cubes of Ordinates.
1	·8	·6	$\frac{1}{3}$	·3	0	0	·5	$\frac{1}{2}$	·2
$1\frac{1}{2}$	4·9	24·0	2	48·0	$\frac{1}{2}$	24·0	117·6	2	235·2
2	8·9	79·2	$1\frac{1}{2}$	118·8	1	118·8	705·0	$1\frac{1}{2}$	1057·5
3	16·2	262·4	4	1049·6	2	2099·2	4251·5	4	17006·0
4	21·2	449·4	2	898·8	3	2696·4	9528·1	2	19056·2
5	23·6	557·0	4	2228·0	4	8912·0	13144·3	4	52577·2
6	24·5	600·3	2	1200·6	5	6003·0	14706·1	2	29412·2
7	24·5	600·3	4	2401·2	6	14407·2	14706·1	4	58824·4
8	24·5	600·3	2	1200·6	7	8404·2	14706·1	2	29412·2
9	24·5	600·3	4	2401·2	8	19209·6	14706·1	4	58824·4
10	24·4	595·4	2	1190·8	9	10717·2	14526·8	2	29053·6
11	23·4	547·6	4	2190·4	10	21904·0	12813·0	4	51252·0
12	19·5	380·3	$1\frac{1}{2}$	570·4	11	6274·4	7414·9	$1\frac{1}{2}$	11122·3
$12\frac{1}{2}$	15·0	225·0	2	450·0	$11\frac{1}{2}$	5175·0	3375·0	2	6750·0
13	1·5	2·3	$\frac{1}{2}$	1·1	12	13·2	3·4	$\frac{1}{3}$	1·7
				15949·8		105958·2			364585·1

INTERMEDIATE WATER PLANE (8 DEGREES).

IMMERSED WEDGE.

Numbers of Ordinates.	Ordinates.	Squares of Ordinates.	Simpson's Multipliers.	Functions of Squares.	Number of Intervals from No. 1.	Longitudinal Moments.	Cubes of Ordinates.	Simpson's Multipliers.	Functions of Cubes of Ordinates.
1	·8	·6	$\frac{1}{3}$	·3	0	0	·5	$\frac{1}{2}$	·2
$1\frac{1}{2}$	5·0	25·0	2	50·0	$\frac{1}{2}$	25·0	125·0	2	250·0
2	9·3	86·5	$1\frac{1}{2}$	129·7	1	129·7	804·4	$1\frac{1}{2}$	1206·6
3	17·0	289·0	4	1156·0	2	2312·0	4913·0	4	19652·0
4	21·8	475·2	2	950·4	3	2851·2	10360·2	2	20720·4
5	24·0	576·0	4	2304·0	4	9216·0	13824·0	4	55296·0
6	24·7	610·1	2	1220·2	5	6101·0	15069·2	2	30138·4
7	24·7	610·1	4	2440·4	6	14642·4	15069·2	4	60276·8
8	24·7	610·1	2	1220·2	7	8541·4	15069·2	2	30138·4
9	24·7	610·1	4	2440·4	8	19523·2	15069·2	4	60276·8
10	24·6	605·2	2	1210·4	9	10893·6	14886·9	2	29773·8
11	24·1	580·8	4	2323·2	10	23232·0	13997·5	4	55990·0
12	21·8	475·2	$1\frac{1}{2}$	712·8	11	7840·8	10360·2	$1\frac{1}{2}$	15540·3
$12\frac{1}{2}$	18·6	346·0	2	692·0	$11\frac{1}{2}$	7958·0	6434·8	2	12869·6
13	1·7	2·9	$\frac{1}{2}$	1·5	12	18·0	4·9	$\frac{1}{2}$	2·5
				16851·5		113284·3			392131·8

EMERGED WEDGE.

Numbers of Ordinates.	Ordinates.	Squares of Ordinates.	Simpson's Multipliers.	Functions of Squares.	Number of Intervals from No. 1.	Longitudinal Moments.	Cubes of Ordinates.	Simpson's Multipliers.	Functions of Cubes of Ordinates.
1	·8	·6	$\frac{1}{3}$	·3	0	0	·5	$\frac{1}{2}$	·2
$1\frac{1}{2}$	4·8	23·0	2	46·0	$\frac{1}{2}$	23·0	110·6	2	221·2
2	8·7	75·7	$1\frac{1}{2}$	113·5	1	113·5	658·5	$1\frac{1}{2}$	987·7
3	15·7	246·5	4	986·0	2	1972·0	3869·9	4	15479·6
4	20·8	432·6	2	865·2	3	2595·6	8998·9	2	17997·8
5	23·6	557·0	4	2228·0	4	8912·0	13144·3	4	52577·2
6	24·7	610·1	2	1220·2	5	6101·0	15069·2	2	30138·4
7	24·8	615·0	4	2460·0	6	14760·0	15253·0	4	61012·0
8	24·8	615·0	2	1230·0	7	8610·0	15253·0	2	30506·0
9	24·8	615·0	4	2460·0	8	19680·0	15253·0	4	61012·0
10	24·4	595·4	2	1190·8	9	10717·2	14526·8	2	29053·6
11	22·6	510·8	4	2043·2	10	20432·0	11543·2	4	46172·8
12	17·4	302·8	$1\frac{1}{2}$	454·2	11	4996·2	5268·0	$1\frac{1}{2}$	7902·0
$12\frac{1}{2}$	12·5	156·3	2	312·6	$11\frac{1}{2}$	3594·9	1953·1	2	3906·2
13	1·3	1·7	$\frac{1}{2}$	·9	12	10·8	2·2	$\frac{1}{3}$	1·1
				15610·9		102518·2			356967·8

INCLINED WATER PLANE (16 DEGREES).

IMMERSED WEDGE.

Numbers of Ordinates.	Ordinates.	Simpson's Multipliers.	Functions of Ordinates.	Squares of Ordinates.	Functions of Squares of Ordinates.	Number of Intervals from No. 1.	Longitudinal Moments.	Cubes of Ordinates.	Simpson's Multipliers.	Functions of Cubes of Ordinates.
1	·9	$\frac{1}{3}$	·4	·8	·4	0	0	·7	$\frac{1}{2}$	·3
$1\frac{1}{2}$	5·2	2	10·4	27·0	54·0	$\frac{1}{2}$	27·0	140·6	2	281·2
2	9·9	$1\frac{1}{2}$	14·9	98·0	147·0	1	147·0	970·3	$1\frac{1}{2}$	1455·5
3	18·1	4	72·4	327·6	1310·4	2	2620·8	5929·7	4	23718·8
4	22·8	2	45·6	519·8	1039·6	3	3118·8	11852·4	2	23704·8
5	24·7	4	98·8	610·1	2440·4	4	9761·6	15069·2	4	60276·3
6	25·3	2	50·6	640·1	1280·2	5	6401·0	16194·3	2	32388·6
7	25·3	4	101·2	640·1	2560·4	6	15362·4	16194·3	4	64777·2
8	25·3	2	50·6	640·1	1280·2	7	8961·4	16194·3	2	32388·6
9	25·3	4	101·2	640·1	2560·4	8	20483·2	16194·3	4	64777·2
10	25·2	2	50·4	635·0	1270·0	9	11430·0	16003·0	2	32006·0
11	24·9	4	99·6	620·0	2480·0	10	24800·0	15438·2	4	61752·8
12	23·8	$1\frac{1}{2}$	35·7	566·4	849·6	11	9345·6	13481·3	$1\frac{1}{2}$	20221·9
$12\frac{1}{2}$	21·9	2	43·8	479·6	959·2	$11\frac{1}{2}$	11030·8	10503·5	2	21007·0
13	2·3	$\frac{1}{2}$	1·2	5·3	2·7	12	32·4	12·2	$\frac{1}{3}$	6·1
			776·8		18234·5		123522·0			438762·8

EMERGED WEDGE.

Numbers of Ordinates.	Ordinates.	Simpson's Multipliers.	Functions of Ordinates.	Squares of Ordinates.	Functions of Squares of Ordinates.	Number of Intervals from No. 1.	Longitudinal Moments.	Cubes of Ordinates.	Simpson's Multipliers.	Functions of Cubes of Ordinates.
1	·9	$\frac{1}{3}$	·4	·8	·4	0	·0	·7	$\frac{1}{2}$	·3
$1\frac{1}{2}$	4·9	2	9·8	24·0	48·0	$\frac{1}{2}$	24·0	117·6	2	235·2
2	8·7	$1\frac{1}{2}$	13·1	75·7	113·5	1	113·5	658·5	$1\frac{1}{2}$	987·7
3	15·6	4	62·4	243·4	973·6	2	1947·2	3796·4	4	15185·6
4	20·7	2	41·4	428·5	857·0	3	2571·0	8869·7	2	17739·4
5	23·7	4	94·8	561·7	2246·8	4	8987·2	13312·1	4	53248·4
6	25·1	2	50·2	630·0	1260·0	5	6300·0	15813·2	2	31626·4
7	25·4	4	101·6	645·2	2580·8	6	15484·8	16387·0	4	65548·0
8	25·4	2	50·8	645·2	1290·4	7	9032·8	16387·0	2	32774·0
9	25·3	4	101·2	640·1	2560·4	8	20483·2	16194·3	4	64777·2
10	24·5	2	49·0	600·3	1200·6	9	10805·4	14706·1	2	29412·2
11	21·5	4	86·0	462·3	1849·2	10	18492·0	9938·4	4	39753·6
12	15·8	$1\frac{1}{2}$	23·7	249·6	374·4	11	4118·4	3944·3	$1\frac{1}{2}$	5916·5
$12\frac{1}{2}$	11·1	2	22·2	123·2	246·4	$11\frac{1}{2}$	2833·6	1367·6	2	2735·2
13	1·2	$\frac{1}{3}$	·6	1·4	·7	12	8·4	1·7	$\frac{1}{2}$	·9
			707·2		15602·2		101201·5			359940·6

TABLE II.—*Continued.*

SPECIMEN CALCULATION FOR SURFACE STATICAL STABILITY.

COMBINATION TABLE.

For Area of Inclined Water Plane.

Immersed Wedge =	776·8
Emerged Wedge =	707·2
	1484·0
⅓ Longitudinal Interval,	29·5 / 3
Area, =	14592·9

For Centre of Gravity of Inclined Water Plane.

Functions of Ordinates,	Immersed,	776·8
	Emerged,	707·2
		1484·0
⅓ Longitudinal Interval,		29·5 / 3
		14592·7
Functions of Squares of Ordinates,	Immersed,	18234·5
	Emerged,	15602·2
		2)2632·3
		1316·2
⅓ Longitudinal Interval,		29·5 / 3
		14592·7)12944·6
C.G. of Area towards Immersed side,		·887

Correction for Statical Stability,
$= 1736{\cdot}1 \times {\cdot}887 = 1540$

For Difference in Volumes of the Wedges.

IMMERSED WEDGE.

Inclinations of Radial Planes.	Functions of Squares of Ordinates.	Simpson's Multipliers.	Functions of Squares for Volumes of Wedges.
0°	15949·8	1	15949·8
8°	16851·5	4	67406·0
16°	18234·5	1	18234·5
			101590·3

EMERGED WEDGE.

0°	15949·8	1	15949·8
8°	15610·9	4	62443·6
16°	15602·2	1	15602·2

For Emerged Wedge -	93995·6
For Immersed Wedge	101590·3
	2)7594·7
	3797·3
⅓ × Angular Interval =	·0465
	176·57
⅓ Longitudinal Interval,	29·5 / 3
Excess in Vol. of Emerged Wedge,	1736·1

For Statical Surface Stability.

BOTH WEDGES.

Sums of Functions of Cubes of Ordinates.	Simpson's Multipliers.	Products of Functions of Cubes.	Cosines of Inclinations	Functions of Cubes for Moments of Wedges.
729170·2	1	729170·2	·96126	700922·1
749099·6	4	2996398·4	·99027	2967243·9
798703·4	1	798703·4	1·00000	798703·4
				3)4466869·4
				1488956·4
⅓ × Angular Interval,				·0465
				69236·4
⅓ Longitudinal Interval,				29·5 / 3
				680824·6
Correction for Layer,				1540·0
Displacement in cubic feet,				209156)679284·6
				3·247 =

BN. (Fig. 1, Plate XVI.).

BM. Sin 16° = 3·247

$$\text{BM.} = \frac{3{\cdot}247}{{\cdot}2756} = 11{\cdot}78$$

Hence Moment of Surface Stability at 16 degrees is $3{\cdot}247 \times 5976 = 19404$ foot-tons.

FOR LONGITUDINAL POSITIONS OF CENTRES OF GRAVITY OF WEDGES.

IMMERSED WEDGE.

Inclinations of Radial Planes.	Functions of Squares of Ordinates.	Simpson's Multipliers.	Products of Functions of Squares.	Longitudinal Moments.	Simpson's Multipliers.	Products of Longitudinal Moments.
0°	15949·8	1	15949·8	105958·2	1	105958·2
8°	16851·5	4	67406·0	113284·3	4	453137·2
16°	18234·5	1	18234·5	123522·0	1	123522 0
			101590·3			)682617·4
						6·72

For Volume of Emerged Wedge -	93995·6
Do. Immersed,	101590·3
	4)195585·9
	48896·4
⅓ Angular Interval, -	·0465
	2273·7
⅓ Longitudinal Interval, -	29·5 / 3
Volume of a Wedge, -	22358 cubic feet = 639 tons.

Longl. Interval, 29·5

198·2 ft. abaft No. 1 Ordinate.
193·5

4·7 ft. = distance of C.G. of Wedge of Immersion abaft that of the Wedge of Emersion.

EMERGED WEDGE.

Inclinations of Radial Planes.	Functions of Squares of Ordinates.	Simpson's Multipliers.	Products of Functions of Squares.	Longitudinal Moments.	Simpson's Multipliers.	Products of Longitudinal Moments.
0°	15949·8	1	15949·8	105958·2	1	105958·2
8°	15610·9	4	62443·6	102518·2	4	410072·8
16°	15602·2	1	15602·2	101201·5	1	101201·5
			93995·6			)617232·5
						6·56

Longitudinal Interval, 29·5

193·5

or 193·5 ft. abaft No 1 Ordinate.

Hence $639 \times 4{\cdot}7 = 3003$ foot-tons, the pitching moment when inclined 16 degrees, due to form of the vessel.

TABLE II.—*Continued.*

SPECIMEN CALCULATION FOR SURFACE DYNAMICAL STABILITY.

COMBINATION TABLE.

FOR DYNAMICAL SURFACE STABILITY. BOTH WEDGES.					
Inclinations of Radial Planes.	Sums of Functions of Cubes of Ordinates.	Simpson's Multipliers.	Products of Functions of Cubes.	Sines of Inclinations.	Functions of Cubes for Moments of Wedges.
0°	729170·2	1	729170·2	·27564	200988·6
8°	749099·6	4	2996398·4	·13917	417008·7
16°	798703·4	1	798703·4	·00000	0·0

CORRECTION FOR DYNAMICAL SURFACE STABILITY.

Excess in Volume of Immersed Wedge = 1827·8.
Thickness of Layer, - - - = 1827·8 ÷ 14590·7.
= ·12 foot = A_1A_2 (Fig. 1, Plate XVI.).
Correction, - - - - - = $1827{\cdot}8 \times \frac{\cdot 12}{2}$.
= 109·7.

3)617997·3
205999·1
$\frac{1}{3}$ × Angular Interval, - = ·0465
9579·0
$\frac{1}{3}$ × Longitudinal Interval, - 29·5
3
94193·5
Correction for Layer, - - 109·7
Displacement in cubic feet = 209156)94083·8
NB_1 = ·45

$NB_1 - A_1A_2 = ·45 - ·12 = ·33$.
AB versin 16° = 8·2 × ·0387 = ·317.
D (·33 − ·317) = 5976 × ·02 = 119·5 foot-tons of mechanical work, which is the Dynamical Surface Stability.

GB versin 16° = 8·529 × ·0387 = ·33.
D (NB_1 − GB versin 16°) = 5976 (·45 − ·33) = 5976 × ·12 = 717·1 foot-tons of mechanical work, which is the Dynamical Stability.

TABLE III.

SPECIMEN PAGE OF RESULTS OF CALCULATION FOR WEIGHT OF HULL, AND POSITION OF ITS CENTRE OF GRAVITY.

Page in Rough Work Book.	ITEM.	Weight.	Leverage about Load Water Line.	Moment. Above L.W.L.	Moment. Below L.W.L.	Leverage about Station No. 35.	Moment. Before No. 35.	Moment. Abaft No. 35.
		Tons.	Ft.	Ft. Tons.	Ft. Tons.	Ft.	Ft. Tons.	Ft. Tons.
1	Armour Plates, Upper Strake of Belt (uniform), ..	129·4	2·5	323·5	..	1·2	..	155·3
1	„ 2nd „ „ „ ..	121·4	·5	..	60·7	2·8	339·9	..
2	„ 3rd „ „ „ ..	86·2	3·5	..	301·7	1·2	..	103·4
2	„ No. 1 Plate, Upper Strake (tapering), ..	14·2	2·5	35·5	..	74	..	1050·8
2	„ 2 „ „ „ ..	12·5	2·5	31·2	..	90	..	1125·0
3	„ 3 „ „ „ ..	11·6	2·5	29·0	..	105·5	..	1223·8
3	„ 4 „ „ „ ..	12·3	2·5	30·7	..	122·5	..	1506·8
3	„ 5 „ „ „ ..	10·0	2·5	25·0	..	136·0	..	1360·0
4	„ 6 „ „ „ ..	8·5	2·5	21·2	..	141·0	..	1198·5
4	„ No. 1 Plate, Middle Strake (tapering), ..	14·2	·5	..	7·1	66·0	..	937·2
4	„ 2 „ „ „ ..	12·5	·5	..	6·2	82·0	..	1025·0
4	„ 3 „ „ „ ..	10·7	·4	..	4·3	98·0	..	1048·6
5	„ 4 „ „ „ ..	10·4	·1	..	1·0	112·5	..	1170·0
5	„ 5 „ „ „ ..	9·6	·2	1·9	..	128·0	..	1228·8
5	„ 6 „ „ „ ..	7·1	·2	1·4	..	137·0	..	972·7
6	„ No. 1 Plate, Lower Strake (tapering), ..	8·9	3·5	..	31·1	74·0	..	658·6
6	„ 2 „ „ „ ..	9·3	3·5	..	32·5	90·0	..	837·0
6	„ 3 „ „ „ ..	8·5	2·5	..	21·2	105·0	..	896·7
6	„ 4 „ „ „ ..	6·2	1·0	..	6·2	119·0	..	737·8
7	„ 5 „ „ „ ..	5·2	·5	..	2·6	133·5	..	694·2
7	„ 6 „ „ „ ..	3·2	3·6	..	11·5	115·5	..	369·6
7	„ 7 „ „ „ ..	5·2	2·0	..	10·4	128·0	..	665·6
8	Armour on Bulkhead, Lowest Strake, ...	70·1	·5	..	35·0	63·5	4451·4	..
8	„ „ Next „	61·7	8·2	505·9	..	63·5	3917·9	..
9	Middle piece above Upper Deck, ...	40·9	16·8	687·1	..	63·5	2597·2	..
9	Side and Embrasure, ...	80·5	16·5	1328·2	..	51·0	4105·2	..
10	Backing on Belt, 1st Strake (uniform), ...	15·4	2·5	38·5	..	1·2	..	18·5
10	„ „ 2 „ „	14·4	·5	..	7·2	2·8	40·3	..
10	„ „ 3 „ „	18·5	3·5	..	64·7	1·2	..	22·2
11	„ „ 1 „ (tapering), ...	10·7	2·5	26·7	..	106·5	..	1139·6
	Totals, ...	829·3		3085·8	603·4		15451·9	20145·7

TABLE IV.

LAP-JOINTED WORK.

PER CENTAGES TO BE ADDED TO THE CALCULATED WEIGHTS OF PLATING* ON ACCOUNT OF LAPS, BUTT STRAPS, AND LINERS.

APPLYING TO BOTTOM PLATING, LAP-JOINTED BULKHEADS, &c.

Thicknesses of Plates.	Diameters of Rivets.	Plates 12 ft. long and 3 ft. wide. — Double Riveted Edges and Double Riveted Butts. — Double Riveted Laps. $5\frac{1}{4}$ diameters wide.	Double Riveted Butt Straps. $11\frac{1}{2}$ diameters wide.	Liners (including wide Liners at Watertight Frames and Bulkheads).	Plates 12 ft. long and 3 ft. wide. — Single Riveted Edges, and Single or Double Riveted Butts. — Single Riveted Laps. $3\frac{3}{4}$ diameters wide.	Single Riveted Butt Straps. $6\frac{1}{2}$ diameters wide.	Double Riveted Butt Straps. $11\frac{1}{2}$ diameters wide.	Liners (including wide Liners at Watertight Frames and Bulkheads).	Plates 16 ft. long and 3 ft. wide. — Single Riveted Edges, and Single or Double Riveted Butts. — Single Riveted Laps. $3\frac{3}{4}$ diameters wide.	Single Riveted Butt Straps. $6\frac{1}{2}$ diameters wide.	Double Riveted Butt Straps. $11\frac{1}{2}$ diameters wide.	Liners (including wide Liners at Watertight Frames and Bulkheads).	Plates 16 ft. long and 3 ft. 3 ins. wide. — Single Riveted Edges and Single Riveted Butts. — Single Riveted Laps. $3\frac{3}{4}$ diameters wide.	Single Riveted Butts. $3\frac{3}{4}$ diameters wide.	Liners to Stiffeners. 2 ft. 6 ins. apart.
In.	In.														
1	$1\frac{1}{4}$	23·60	7·91	4·18	12·72	5·00	8·85	5·24	12·72	3·75	6·64	5·24	10·47	2·12	4·20
$\frac{7}{8}$	$1\frac{1}{8}$	20·75	7·35	4·45	11·30	4·57	8·07	5·39	11·30	3·43	6·05	5·39	9·38	1·91	4·32
1	1	18·03	6·78	4·71	9·92	4·10	7·27	5·55	9·92	3·08	5·45	5·55	8·34	1·70	4·44
$\frac{7}{8}$	$\frac{7}{8}$	15·43	6·07	4·98	8·56	3·63	6·42	5·70	8·56	2·73	4·82	5·70	7·29	1·46	4·56
$\frac{3}{4}$	$\frac{3}{4}$	12·94	5·32	5·24	7·26	3·16	5·59	5·85	7·26	2·37	4·19	5·85	6·25	1·27	4·68
$\frac{5}{8}$	$\frac{5}{8}$	10·58	4·50	5·51	5·97	2·66	4·70	6·01	5·97	2·00	3·52	6·01	5·21	1·06	4·81
$\frac{1}{2}$	$\frac{1}{2}$	8·27	3·69	5·75	4·73	2·16	3·81	6·17	4·73	1·62	2·86	6·17	4·17	·85	4·94

* In using the above table, first calculate the weight of the Plating by measuring the exact area of the surface, then add the per centage for Laps, after which apply the per centage for Butt Straps and Liners, and add the whole together.

FLUSH-JOINTED WORK.

PER CENTAGES TO BE ADDED TO THE CALCULATED WEIGHTS OF PLATING ON ACCOUNT OF EDGE STRIPS AND BUTT STRAPS.

Thicknesses of Plates.	Diameters of Rivets.	Plates 16 feet long. Butt Straps full breadth of Plate. — Per centages applicable to Vertical Keel, Longitudinals, Stringers, &c. — Treble Riveted Double Straps, each 1·16 in. more than half the thickness of the Plates. $16\frac{1}{2}$ diameters width of Straps.	Treble Riveted Double Straps, each half the thickness of the Plate. $16\frac{1}{2}$ diameters width of Straps.	Double Riveted Double Straps, each half the thickness of the Plate. $11\frac{1}{2}$ diameters width of Straps.	Single Riveted Double or Single Straps. If Double, each Strap half the thickness of the Plate. $6\frac{1}{2}$ diameters width of Straps.	Plates 16 ft. long and 3 ft. 3 ins. wide, per centage applicable to Deck Plating, Inner Bottom Plating, Flush-Jointed Bulkheads, &c. — Double Riveting for both Edges and Butts. — Double Riveted Edge Strips. $11\frac{1}{2}$ diameters wide.	Double Riveted Butt Straps, when on opposite side to Edge Strips. $11\frac{1}{2}$ diameters wide.	Double Riveted Butt Straps, when on same side as Edge Strips. $11\frac{1}{2}$ diameters wide.	Single Riveted Edges and Double Riveted Butts. — Single Riveted Edge Strips. $6\frac{1}{2}$ diameters wide.	Double Riveted Butt Straps, when on opposite side to Edge Strips. $11\frac{1}{2}$ diameters wide.	Double Riveted Butt Straps, when on same side as Edge Strips. $11\frac{1}{2}$ diameters wide.	Single Riveting for both Edges and Butts. — Edge Strips. $6\frac{1}{2}$ diameters wide.	Butt Straps on opposite side to Edge Strips. $6\frac{1}{2}$ diameters wide.	Butt Straps on same side as Edge Strips. $6\frac{1}{2}$ diameters wide.
In.	In.														
1	$1\frac{1}{4}$	12·08	10·74	7·48	4·23	35·26	7·49	4·85	20·83	7·49	5·94	20·83	4·24	3·36
$\frac{7}{8}$	$1\frac{1}{8}$	11·05	9·67	6·74	3·81	31·74	6·74	4·60	18·75	6·74	5·48	18·75	3·81	3·10
1	1	10·03	8·60	6·00	3·40	28·21	5·99	4·30	16·67	5·99	5·00	16·67	3·39	2·83
$\frac{7}{8}$	$\frac{7}{8}$	9·02	7·52	5·24	3·00	24·68	5·14	3·92	14·58	5·14	4·45	14·58	2·91	2·52
$\frac{3}{4}$	$\frac{3}{4}$	8·05	6·44	4·49	2·54	21·15	4·49	3·54	12·49	4·49	3·93	12·49	2·54	2·23
$\frac{5}{8}$	$\frac{5}{8}$	7·16	5·37	3·75	2·12	17·63	3·74	3·06	10·42	3·74	3·38	10·42	2·11	1·91
$\frac{1}{2}$	$\frac{1}{2}$	6·44	4·29	3·00	1·70	14·10	2·99	2·57	8·33	2·99	2·74	8·33	1·70	1·55

TABLE V.

WEIGHTS OF THE BUTTERLY CO.'S PATENT SOLID WROUGHT IRON T-BULB DECK BEAMS AS SUPPLIED BY THEM.

Makers No. of Section.	DIMENSIONS.				Average Weight per Lineal Foot.
	Depth of Beam.	Width of Flange.	Width of Bulb.	Thickness of Web (about).	
No.	Inches.	Inches.	Inches.	Inches.	Lbs.
1	16	$6\frac{1}{4}$	$3\frac{1}{4}$	$\frac{9}{16}$	53 to 56
2	15	$6\frac{1}{4}$	$3\frac{1}{4}$	$\frac{9}{16}$	52 „ 55
3	14	$6\frac{1}{4}$	$3\frac{1}{4}$	$\frac{9}{16}$	50 „ 54
4	13	$6\frac{1}{4}$	$3\frac{1}{4}$	$\frac{9}{16}$	49 „ 53
5	12	$6\frac{1}{4}$	$3\frac{1}{4}$	$\frac{9}{16}$	47 „ 50
6	11	$6\frac{1}{2}$	$2\frac{1}{4}$	$\frac{1}{2}$	43 „ 44
7	10	6	$2\frac{1}{8}$	$\frac{7}{16}$	35 „ 37
9	9	$6\frac{1}{4}$	$3\frac{1}{4}$	$\frac{9}{16}$	42 „ 45
10	9	$5\frac{1}{2}$	2	$\frac{1}{2}$	31 „ 33
12	8	$5\frac{1}{4}$	$1\frac{7}{8}$	$\frac{7}{16}$	27 „ 28
13	7	5	$1\frac{3}{4}$	$\frac{7}{16}$	22 „ 25
15	6	5	$1\frac{5}{8}$	$\frac{7}{16}$	19 „ 20
17	5	4	$1\frac{1}{2}$	$\frac{7}{16}$	$14\frac{1}{2}$ „ 16
18	4	3	1	$\frac{5}{8}$	$9\frac{1}{2}$
ANGLE BULB.					
19	$6\frac{1}{2}$	$3\frac{1}{2}$	$\frac{15}{16}$	$\frac{1}{2}$	16 „ 17
20	5	$2\frac{1}{2}$	$\frac{15}{16}$	$\frac{7}{16}$	$11\frac{1}{2}$ „ 12

PLATE BULB IRON.

This form of section is rolled by many makers, and of many widths of web; the thickness of the latter for each width is also varied within the limits of about $\frac{1}{4}$ to $\frac{5}{16}$ of an inch. It is consequently impossible to compile a useful table of the weights per lineal foot of these beams; but the weight in any specific case may be easily obtained by first calculating the weight per lineal foot due to the width and thickness of the web, and adding thereto the weight of a lineal foot of round iron whose diameter is twice the thickness of the web when the latter is $\frac{3}{4}$ inch, and $2\frac{3}{4}$ times when it is $\frac{3}{8}$ inch; the diameters of the intermediate sizes varying in the inverse proportion of the thicknesses.

WEIGHTS PER LINEAL FOOT OF WROUGHT IRON BARS HAVING ROUND AND SQUARE SECTIONS.

Diameter or Side in Inches.	Weight per Lineal Foot.		Diameter or Side in Inches.	Weight per Lineal Foot.	
	Round.	Square.		Round.	Square.
	Lbs.	Lbs.		Lbs.	Lbs.
$\frac{1}{4}$	·164	·209	6	94·29	120·00
$\frac{3}{8}$	·368	·469	$6\frac{1}{4}$	102·31	130·21
$\frac{1}{2}$	·655	·833	$6\frac{1}{2}$	110·65	140·83
$\frac{5}{8}$	1·023	1·302	$6\frac{3}{4}$	119·33	151·88
$\frac{3}{4}$	1·473	1·880	7	128·33	163·33
$\frac{7}{8}$	2·005	2·552	$7\frac{1}{4}$	137·66	175·21
1	2·62	3·33	$7\frac{1}{2}$	147·32	187·50
$1\frac{1}{4}$	4·09	5·21	$7\frac{3}{4}$	157·31	200·21
$1\frac{1}{2}$	5·89	7·50	8	167·62	213·33
$1\frac{3}{4}$	8·02	10·21	$8\frac{1}{4}$	178·26	226·88
2	10·48	13·33	$8\frac{1}{2}$	189·22	240·83
$2\frac{1}{4}$	13·26	16·88	$8\frac{3}{4}$	200·52	255·21
$2\frac{1}{2}$	16·37	20·83	9	212·14	270·00
$2\frac{3}{4}$	19·81	25·21	$9\frac{1}{4}$	224·10	285·21
3	23·58	30·00	$9\frac{1}{2}$	236·37	300·83
$3\frac{1}{4}$	27·67	35·21	$9\frac{3}{4}$	248·98	316·88
$3\frac{1}{2}$	32·08	40·83	10	261·90	333·33
$3\frac{3}{4}$	36·83	46·88	$10\frac{1}{4}$	275·16	350·21
4	41·91	53·33	$10\frac{1}{2}$	288·75	367·50
$4\frac{1}{4}$	47·31	60·21	$10\frac{3}{4}$	302·66	385·21
$4\frac{1}{2}$	53·04	67·50	11	316·90	403·33
$4\frac{3}{4}$	59·09	75·21	$11\frac{1}{4}$	331·47	421·88
5	65·48	83·33	$11\frac{1}{2}$	346·37	440·83
$5\frac{1}{4}$	72·19	91·88	$11\frac{3}{4}$	361·59	460·21
$5\frac{1}{2}$	79·23	100·83	12	377·14	480·00
$5\frac{3}{4}$	86·59	110·21			

TABLE VI.

WEIGHTS OF ANGLE AND T-IRON IN LBS. PER LINEAL FOOT.

Sum of Breadths of Flanges.	THICKNESSES IN FRACTIONS OF AN INCH.												Sum of Breadths of Flanges.
	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	
Inches.													Inches.
3	1·758	2·292	2·800										3
$3\frac{1}{2}$	2·070	2·708	3·320	3·906									$3\frac{1}{2}$
4	2·383	3·125	3·841	4·531	5·195								4
$4\frac{1}{2}$	2·695	3·542	4·400	5·160	5·925	6·666							$4\frac{1}{2}$
5	3·008	3·958	4·883	5·781	6·653	7·500							5
$5\frac{1}{2}$	3·320	4·375	5·404	6·406	7·383	8·333	9·258						$5\frac{1}{2}$
6	3·633	4·792	5·925	7·031	8·112	9·166	10·196	11·200	12·175	13·125	14·050	14·948	6
$6\frac{1}{2}$	3·945	5·209	6·446	7·656	8·843	10·000	11·133	12·240	13·320	14·375	15·404	16·406	$6\frac{1}{2}$
7	4·258	5·626	6·967	8·281	9·572	10·833	12·070	13·282	14·466	15·625	16·758	17·865	7
$7\frac{1}{2}$	4·570	6·042	7·488	8·906	10·301	11·666	13·008	14·323	15·612	16·875	18·112	19·323	$7\frac{1}{2}$
8	4·883	6·459	8·008	9·531	11·030	12·500	13·945	15·365	16·758	18·125	19·467	20·781	8
$8\frac{1}{2}$	5·195	6·876	8·529	10·156	11·759	13·333	14·883	16·407	17·904	19·375	20·820	22·234	$8\frac{1}{2}$
9	5·508	7·292	9·050	10·781	12·489	14·166	15·820	17·448	19·050	20·625	22·174	23·698	9
$9\frac{1}{2}$	5·820	7·709	9·570	11·406	13·218	15·000	16·758	18·490	20·195	21·875	23·523	25·156	$9\frac{1}{2}$
10	6·133	8·125	10·090	12·031	13·947	15·833	17·695	19·532	21·341	23·125	24·883	26·614	10
$10\frac{1}{2}$	6·445	8·542	10·612	12·656	14·676	16·666	18·633	20·573	22·487	24·375	26·237	28·073	$10\frac{1}{2}$
11					15·405	17·500	19·570	21·615	23·633	25·625	27·591	29·531	11
$11\frac{1}{2}$					16·135	18·333	20·508	22·657	24·780	26·875	28·945	30·990	$11\frac{1}{2}$
12					16·864	19·166	21·445	23·700	25·924	28·125	30·300	32·448	12
$12\frac{1}{2}$					17·593	20·000	22·383	24·740	27·070	29·375	31·654	33·906	$12\frac{1}{2}$
13					18·322	20·833	23·320	25·781	28·216	30·625	33·008	35·365	13
$13\frac{1}{2}$					18·960	21·666	24·257	26·823	29·362	31·875	34·362	36·823	$13\frac{1}{2}$
14						22·500	25·195	27·865	30·508	33·125	35·716	38·281	14

TABLE VII.

CALCULATION FOR CURVE OF STABILITY.

No. 1.—PRELIMINARY TABLE.

UPRIGHT WATER SECTION.

IMMERSED WEDGE.

No. of Section.	Ordinates.	Multipliers.	Functions of Ordinates.	Squares of Ordinates.	Multipliers.	Functions of Squares.	Cubes of Ordinates.	Multipliers.	Functions of Cubes.
1	·8	½	·4	·6	½	·3	·5	½	·2
1½	4·9	2	9·8	24·0	2	48·0	117·6	2	235·2
2	8·9	1½	13·4	79·2	1½	118·8	705·0	1½	1057·5
3	16·2	4	64·8	262·4	4	1049·6	4251·5	4	17006·0
4	21·2	2	42.4	449·4	2	898·8	9528·1	2	19056·2
5	23·6	4	94·4	557·0	4	2228·0	13144·3	4	52577·2
6	24·5	2	49·0	600·3	2	1200·6	14706·1	2	29412·2
7	24·5	4	98·0	600·3	4	2401·2	14706·1	4	58824·4
8	24·5	2	49·0	600·3	2	1200·6	14706·1	2	29412·2
9	24·5	4	98·0	600·3	4	2401·2	14706·1	4	58824·4
10	24·4	2	48·8	595·4	2	1190·8	14526·8	2	29053·6
11	23·4	4	93·6	547·6	4	2190·4	12813·0	4	51252·0
12	19·5	1½	29·2	380·3	1½	570·4	7414·9	1½	11122·3
12½	15·0	2	30·0	225·0	2	450·0	3375·0	2	6750·0
13	1·5	½	·8	2·3	½	1·1	3·4	½	1·7
			3)721·6			3)15949·8			3)364585·1
			240·5			5316·6			121528·4
									2
							For both Wedges ..		243056·8

EMERGED WEDGE.

Same as Immersed Wedge.

TABLE VII.—*Continued.*

CALCULATION FOR CURVE OF STABILITY.

No. 2.—PRELIMINARY TABLE.

WATER SECTION INCLINED AT 8 DEGREES.

IMMERSED WEDGE.

No. of Section.	Ordinates.	Multipliers.	Functions of Ordinates.	Squares of Ordinates.	Multipliers.	Functions of Squares.	Cubes of Ordinates.	Multipliers.	Functions of Cubes.
	·8	½	·4	·6	½	·3	·5	½	·2
1	5·0	2	10·0	25·0	2	50·0	125·0	2	250·0
1½	9·3	1½	14·0	86·5	1½	129·7	804·4	1½	1206·6
2	17·0	4	68·0	289·0	4	1156·0	4913·0	4	19652·0
3	21·8	2	43·6	475·2	2	950·4	10360·2	2	20720·4
4	24·0	4	96·0	576·0	4	2304·0	13824·0	4	55296·0
5	24·7	2	49·4	610·1	2	1220·2	15069·2	2	30138·4
6	24·7	4	98·8	610·1	4	2440·4	15069·2	4	60276·8
7	24·7	2	49·4	610·1	2	1220·2	15069·2	2	30138·4
8	24·7	4	98·8	610·1	4	2440·4	15069·2	4	60276·8
9	24·7	2	49·2	605·2	2	1210·4	14886·9	2	29773·8
10	24·6	4	96·4	580·8	4	2323·2	13997·5	4	55990·0
11	24·1	1½	32·7	475·2	1½	712·8	10360·2	1½	15540·3
12	21·8	2	37·2	346·0	2	792·0	6434·8	2	12869·6
12½	18·6		·8	2·9	½	1·5	4·9	½	2·5
13	1·7	½							
			3)744·7			3)16951·5			3)392131·8
			248·2			5650·3			130710·6
							Immersed		118989·3
							Emerged		
							Sum		249699·9

EMERGED WEDGE.

	·8	½	·4	·6	½	·3	·5	½	·2
1	4·8	2	9·6	23·0	2	46·0	110·6	2	221·2
1½	8·7	1½	13·0	75·7	1½	113·5	658·5	1½	987·7
2	15·7	4	62·8	246·5	4	986·0	3869·9	4	15479·6
3	20·8	2	41·6	432·6	2	865·2	8998·9	2	17997·8
4	23·6	4	94·4	557·0	4	2228·0	13144·3	4	52577·2
5	24·7	2	49·4	610·1	2	1220·2	15069·2	2	30138·4
6	24·8	4	99·2	615·0	4	2460·0	15253·0	4	61012·0
7	24·8	2	49·6	615·0	2	1230·0	15253·0	2	30506·0
8	24·8	4	99·2	615·0	4	2460·0	15253·0	4	61012·0
9	24·8	2	48·8	595·4	2	1190·8	14526·8	2	29053·6
10	24·4	4	90·4	510·8	4	2043·2	11543·2	4	46172·8
11	22·6	1½	26·1	302·8	1½	454·2	5268·0	1½	7902·0
12	17·4	2	25·0	156·3	2	312·6	1953·1	2	3906·2
12½	12·5		·7	1·7	½	·9	2·2	½	1·1
13	1·3	½							
			3)710·2			3)15610·9			3)356967·8
			236·7			5203·6			118989·3

TABLE VII.—*Continued.*

CALCULATION FOR CURVE OF STABILITY.

No. 3.—PRELIMINARY TABLE.

WATER SECTION INCLINED AT 16 DEGREES.

IMMERSED WEDGE.

No. of Section.	Ordinates.	Multipliers.	Functions of Ordinates.	Squares of Ordinates.	Multipliers.	Functions of Squares.	Cubes of Ordinates.	Multipliers.	Functions of Cubes.
1	·9	½	·4	·8	½	·4	·7	½	·3
1½	5·2	2	10·4	27·0	2	54·0	140·6	2	281·2
2	9·9	1½	14·9	98·0	1½	147·0	970·3	1½	1455·5
3	18·1	4	72·4	327·6	4	1310·4	5929·7	4	23718·8
4	22·8	2	45·6	519·8	2	1039·6	11852·4	2	23704·8
5	24·7	4	98·8	610·1	4	2440·4	15069·2	4	60276·8
6	25·3	2	50·6	640·1	2	1280·2	16194·3	2	32388·6
7	25·3	4		640·1	4		16194·3	4	
8	25·3	2	253·0	640·1	2	6401·0	16194·3	2	161943·0
9	25·3	4		640·1	4		16194·3	4	
10	25·2	2	50·4	635·0	2	1270·0	16003·0	2	32006·0
11	24·9	4	99·6	620·0	4	2480·0	15438·2	4	61752·8
12	23·8	1½	35·7	566·4	1½	849·6	13481·3	1½	20221·9
12½	21·9	2	43·8	479·6	2	959·2	10503·5	2	21007·0
13	2·3	½	1·2	5·3	½	2·7	12·2	½	6·1
			3)776·8			3)18234·5			3)438762·8
			258·9			6078·2			146254·3
							Immersed		119980·2
							Emerged		
							Sum ..	.. ..	266234·5

EMERGED WEDGE.

1	·9	½	·4	·8	½	·4	·7	½	·3
1½	4·9	2	9·8	24·0	2	48·0	117·6	2	235·2
2	8·7	1½	13·1	75·7	1½	113·5	658·5	1½	987·7
3	15·6	4	62·4	243·4	4	973·6	3796·4	4	15185·6
4	20·7	2	41·4	428·5	2	857·0	8869·7	2	17739·4
5	23·7	4	94·8	561·7	4	2246·8	13312·1	4	53248·4
6	25·1	2	50·2	630·0	2	1260·0	15813·2	2	31626·4
7	25·4	4		645·2	4		16387·0	4	
8	25·4	2	152·4	645·2	2	3871·2	16387·0	2	98322·0
9	25·3	4		640·1	4		16194·3	4	
10	24·5	2	101·2	600·3	2	2560·4	14706·1	2	64777·2
11	21·5	4	49·0	462·3	4	1200·6	9938·4	4	29412·2
12	15·8	1½	86·0	249·6	1½	1849·2	3944·3	1½	39753·6
12½	11·1	2	23·7	123·2	2	374·4	1367·6	2	5916·5
13	1·2	½	22·2	1·4	½	246·4	1·7	½	2735·2
			·6			·7			·9
			3)707·2			3)15602·2			3)359940·6
			235·7			5200·7			119980·2

TABLE VII.—*Continued.*

CALCULATION FOR CURVE OF STABILITY.

No. 4.—PRELIMINARY TABLE.

WATER SECTION INCLINED AT 24 DEGREES.

IMMERSED WEDGE.

No. of Section.	Ordinates.	Multipliers.	Functions of Ordinates.	Squares of Ordinates.	Multipliers.	Functions of Squares.	Cubes of Ordinates.	Multipliers.	Functions of Cubes.
1	·9	½	·4	·8	½	·4	·7	½	·3
1½	5·7	2	11·4	32·5	2	65·0	185·2	2	370·4
2	10·9	1½	16·4	118·8	1½	278·2	1295·0	1½	1942·5
3	19·8	4	79·2	392·0	4	1568·0	7762·4	4	31049·6
4	24·4	2	48·8	595·4	2	1190·8	14526·8	2	29053·6
5	26·0	4	104·0	676·0	4	2704·0	17576·0	4	70304·0
6	26·5	2	53·0	702·3	2	1404·6	18609·6	2	37219·2
7	26·5	4	265·0	702·3	4	7023·0	18609·6	4	186096·0
8	26·5	2		702·3	2		18609·6	2	
9	26·5	4		702·3	4		18609·6	4	
10	26·4	2	52·8	697·0	2	1394·0	18399·7	2	36799·4
11	26·1	4	104·4	681·2	4	2724·8	17779·6	4	71118·4
12	25·3	1½	37·9	640·1	1½	960·1	16194·3	1½	24291·4
12½	23·9	2	47·8	571·2	2	1142·4	13651·9	2	27303·8
13	19·1	½	9·5	364·8	½	182·4	6967·9	½	3483·9
			3)830·6			3)20637·7			3)519032·5
			276·9			6879·2	Immersed		173010·8
							Emerged		120923·7
							Sum		293934·5

EMERGED WEDGE.

1	·9	½	·4	·8	½	·4	·7	½	·4
1½	5·0	2	10·0	25·0	2	50·0	125·0	2	250·0
2	8·8	1½	13·2	77·4	1½	116·1	681·5	1½	1022·2
3	15·6	4	62·4	243·4	4	973·6	3796·4	4	15185·6
4	20·6	2	41·2	424·4	2	848·8	8741·8	2	17483·6
5	23·9	4	95·6	571·2	4	2284·8	13651·9	4	54607·6
6	25·5	2	51·0	650·3	2	1300·6	16581·4	2	33162·8
7	26·0	4	104·0	676·0	4	2704·0	17576·0	4	70304·0
8	26·0	2	52·0	676·0	2	1352·0	17576·0	2	35152·0
9	25·6	4	102·4	655·4	4	2621·6	16777·2	4	67108·8
10	24·1	2	48·2	580·8	2	1161·6	13997·5	2	27995·0
11	20·4	4	81·6	416·2	4	1664·8	8489·7	4	33958·8
12	14·4	1½	21·6	207·4	1½	311·1	2986·0	1½	4479·0
12½	10·1	2	20·2	102·0	2	204·0	1030·3	2	2060·6
13	1·2	½	·6	1·4	½	·7	1·7	½	·8
			3)704·4			3)15594·1			3)362771·2
			234·8			5198·0			120923·7

TABLE VII.—*Continued.*

CALCULATION FOR CURVE OF STABILITY.

No. 5.—PRELIMINARY TABLE.

WATER SECTION INCLINED AT 32 DEGREES.

IMMERSED WEDGE.

No. of Section.	Ordinates.	Multipliers.	Functions of Ordinates.	Squares of Ordinates.	Multipliers.	Functions of Squares.	Cubes of Ordinates.	Multipliers.	Functions of Cubes.
1	·9	½	·4	·8	½	·4	·7	½	·3
1½	6·2	2	12·4	38·4	2	76·8	238·3	2	476·6
2	12·3	1½	18·4	151·3	1½	226·9	1860·9	1½	2791·3
3	22·2	4	88·8	492·8	4	1971·2	10941·0	4	43764·0
4	26·5	2	53·0	702·2	2	1404·4	18609·6	2	37219·2
5	27·9	4	111·6	778·4	4	3113·6	21717·6	4	86870·4
6	28·3	2	56·6	800·9	2	1601·8	22665·2	2	45330·4
7	28·3	4	113·2	800·9	4	3203·6	22665·2	4	90660·8
8	28·1	2	56·2	789·6	2	1579·2	22188·0	2	44376·0
9	27·8	4	111·2	772·8	4	3091·2	21484·9	4	85939·6
10	27·5	2	55·0	756·2	2	1512·4	20796·9	2	41593·8
11	27·6	4	110·4	761·8	4	3047·2	21024·6	4	84098·4
12	27·0	1½	40·5	729·0	1½	1093·5	19683·0	1½	29524·5
12½	25·7	2	51·4	660·5	2	1321·0	16974·6	2	33949·2
13	23·0	½	11·5	529·0	½	264·5	12167·0	½	6083·5
			3)890·6			3)23507·7			3)632678·0
			296·9			7835·9	Immersed		210892·7
							Emerged		115565·2
							Sum ..	.. ..	326457·9

EMERGED WEDGE.

1	1·1	½	·5	1·2	½	·6	1·3	½	·6
1½	5·3	2	10·6	28·1	2	56·2	148·9	2	297·8
2	9·2	1½	13·8	84·6	1½	126·9	778·7	1½	1168·0
3	15·8	4	63·2	249·6	4	998·4	3944·3	4	15777·2
4	20·7	2	41·4	428·5	2	857·0	8869·7	2	17739·4
5	23·7	4	94·8	561·7	4	2246·8	13312·0	4	53248·0
6	25·3	2	50·6	640·1	2	1280·2	16194·3	2	32388·6
7	25·9	4	103·6	670·8	4	2683·2	17374·0	4	69496·0
8	25·9	2	51·8	670·8	2	1341·6	17374·0	2	34748·0
9	25·1	4	100·4	630·0	4	2520·0	15813·2	4	63252·8
10	23·0	2	46·0	529·0	2	1058·0	12167·0	2	24334·0
11	19·3	4	77·2	372·5	4	1490·0	7189·1	4	28756·4
12	13·6	1½	20·4	185·0	1½	277·5	2515·4	1½	3773·1
12½	9·5	2	19·0	90·2	2	180·4	857·4	2	1714·8
13	1·2	½	·6	1·4	½	·7	1·7	½	·8
			3)693·9			3)15117·5			3)346695·5
			231·3			5039·2			115565·2

TABLE VII.—*Continued.*

CALCULATION FOR CURVE OF STABILITY.

No. 1.—COMBINATION TABLE.

CALCULATION OF STABILITY AT AN INCLINATION OF 8 DEGREES.

IMMERSED WEDGE.

Inclinations of Radial Planes.	Functions of Ordinates for Area of Inclined Water Section.	Functions of Squares of Ordinates.	Multipliers.	Functions of Squares of Ordinates for Volumes of Wedges.
Degrees.				
0	..	5316·6	5	26583·0
8	248·2	5650·5	8	45204·0
16	..	6078·2	−1	−6078·2

For Immersed Wedge .. .. .. 65708·8
For Emerged Wedge .. .. .. 63011·1

2)2697·7

1348·8
$\frac{1}{12}$ × Angular Interval .. .. .. ·0116

15·6
Longitudinal Interval .. .. .. 29·5

Excess in Volume of Immersed Wedge without the Appendage .. .. 460·2

EMERGED WEDGE.

0	..	5316·6	5	26583·0
8	236·7	5203·6	8	41628·8
16	..	5200·7	−1	−5200·7
				63011·1

OUTLYING APPENDAGE.

In this case the Outlying Appendage is so very small that it can be safely neglected.

BOTH WEDGES.

Sums of Functions of Cubes of Ordinates.	Multipliers.	Products of Functions of Cubes.	Statical Stability. Cosines of Inclinations.	Statical Stability. Functions of Cubes for Moments of Wedges.	Dynamical Stability. Sines of Inclinations.	Dynamical Stability. Functions of Cubes for Moments of Wedges.
243056·8	5	1215284·0	·99027		·13917	
249699·9	8	1997599·2	1·00000	2937414·4	·00000	206182·9
266234·5	−1	−266234·5	·99027		·13917	
				3)2937414·4		3)206182·9
				979138·1		68727·6
				$\frac{1}{12}$ × Angular Interval .. .. ·0116		·0116
				11358·0		797·24
				Longitudinal Interval .. .. 29·5		29·5
				Moment of Wedges (uncorrected) .. .. 335061·0		23518·6
				Correction for Appendage .. .. .. 0·0		0·0
				„ „ Layer .. .. −211·7		−6·9
				209156)334849·3		209156)23511·7
				BN = ... 1·601		B_1N = .. ·112
				BG sin. θ = 8·529 × ·1392 = ... 1·187		BG vers. θ = 8·529 × ·0097 .. = ·083
				GZ = ... ·414		·029
				Displacement 5976		5976
				Righting Moment in foot-tons .. .. 2474·1		Work in foot-tons 173·3

INCLINED WATER SECTION.

Functions of Ordinates	Immersed ..	248·2
	Emerged	236·7
		484·9
Longitudinal Interval		29·5
Total Area		14304·5

Functions of Squares of Ordinates	Immersed	5650·5
	Emerged	5203·6
		2)446·9
		223·45
Longitudinal Interval, ...		29·5
		14304·5)6591·8
C. G. of Area towards the Immersed side ..		·46

CORRECTING LAYER.

Excess in Volume of the Immersed Wedge (found above) .. .. 460·2

Thickness of Layer = 460·2 ÷ 14304·5 = ·03 foot.

Correction for Statical Stability = 460·2 × ·46 = 211·7.

Correction for Dynamical Stability = 460·2 × ·015 = 6·9.

TABLE VII.—*Continued.*

CALCULATION FOR CURVE OF STABILITY.

No. 2.—COMBINATION TABLE.

CALCULATION OF STABILITY AT AN INCLINATION OF 16 DEGREES.

IMMERSED WEDGE.

Inclinations of Radial Planes.	Functions of Ordinates for Area of Inclined Water Section.	Functions of Squares of Ordinates.	Multipliers.	Functions of Squares of Ordinates for Volumes of Wedges.
Degrees.				
0	..	5316·6	1	5316·6
8	..	5650·5	4	22602·0
16	258·9	6078·2	1	6078·2

For Immersed Wedge .. .. .. 33996·8
For Emerged Wedge .. .. .. 31331·7

2)2665·1

1332·5
⅓ × Angular Interval .. .. .. ·0465

61·96
Longitudinal Interval .. .. .. 29·5

Excess in Volume of the Immersed Wedge without Appendage .. 1827·8

EMERGED WEDGE.

0	..	5316·6	1	5316·6
8	..	5203·6	4	20814·4
16	235·7	5200·7	1	5200·7
				31331·7

OUTLYING APPENDAGE.

In this case the Appendage is so very small that it can be safely neglected.

BOTH WEDGES.

Sums of Functions of Cubes of Ordinates.	Multipliers.	Products of Functions of Cubes.	Statical Stability. Cosines of Inclinations.	Statical Stability. Functions of Cubes for Moments of Wedges.	Dynamical Stability. Sines of Inclinations.	Dynamical Stability. Functions of Cubes for Moments of Wedges.
243056·8	1	243056·8	·96126	233640·8	·27564	66996·2
249699·9	4	998799·6	·99027	989081·3	·13917	139002·9
266234·5	1	266234·5	1·00000	266234·5	·00000	0·0
				3)1488956·6		3)205999·1
				496318·9		68666·4
⅓ × Angular Interval				·0465		·0465
				23078·8		3193·0
Longitudinal Interval				29·5		29·5
Moment of Wedges (uncorrected)				680824·6		94193·5
Correction for Appendage				0·0		0·0
„ „ Layer				−1645·0		−109·7
				209156)679179·6		209156)94083·8
B N = ...				3·247	B$_1$N = ..	·45
B G sin. θ = 8·529 × ·2756 = ...				2·351	B G vers. θ = 8·529 × ·0387 .. =	·33
G Z = ...				·896		·12
Displacement				5976		5976
Righting Moment in foot tons				5354·5	Work in foot-tons	717·1

INCLINED WATER SECTION.

Functions of Ordinates	Immersed ..	258·9
	Emerged	235·7
		494·6
Longitudinal Interval		29·5
Total Area		14590·7

Functions of Squares of Ordinates	Immersed	6078·2
	Emerged	5200·7
		2)877·5
		438·8
Longitudinal Interval		29·5
		14590·7)12944·6
C. G. of Area towards Immersed side ..		·887

CORRECTING LAYER.

Excess in Volume of the Immersed Wedge (found above) .. .. 1827·8

Thickness of Layer = 1827·8 ÷ 14590·7 = ·12 foot.

Correction for Statical Stability = 1827·8 × ·9 = 1645·0.

Correction for Dynamical Stability = 1827·8 × ·06 = 109·7.

TABLE VII.—*Continued.*

CALCULATION FOR CURVE OF STABILITY.

No. 3.—COMBINATION TABLE.

CALCULATION OF STABILITY AT AN INCLINATION OF 24 DEGREES.

IMMERSED WEDGE.

Inclinations of Radial Planes.	Functions of Ordinates for Area of Inclined Water Section.	Functions of Squares of Ordinates.	Multipliers.	Functions of Squares of Ordinates for Volumes of Wedges.
Degrees.				
0	..	5316·6	1	5316·6
8	..	5650·5	3	16951·5
16	..	6078·2	3	18234·6
24	276·9	6879·2	1	6879·2

For Immersed Wedge	47381·9
For Emerged Wedge	41727·5
	5654·4
$\frac{1}{16}$ × Angular Interval	·0262
	148·1
Longitudinal Interval	29·5
Excess in Volume of the Immersed Wedge without the Appendage ..	4369·0

EMERGED WEDGE.

0	..	5316·6	1	5316·6
8	..	5203·6	3	15610·8
16	..	5200·7	3	15602·1
24	234·8	5198·0	1	5198·0
				41727·5

OUTLYING APPENDAGE.

In this case the Appendage is so very small that it can be safely neglected.

BOTH WEDGES.

Sums of Functions of Cubes of Ordinates.	Multipliers.	Products of Functions of Cubes.	Statical Stability. Cosines of Inclinations.	Statical Stability. Functions of Cubes for Moments of Wedges.	Dynamical Stability. Sines of Inclinations.	Dynamical Stability. Functions of Cubes for Moments of Wedges.
213056·8	1	213056·8	·91355	222044·5	·40674	98860·9
249699·9	3	749099·7	·96126	720079·6	·27564	206481·8
266234·5	3	798703·5	·99027	790932·1	·13917	111155·6
293934·5	1	293934·5	1·00000	293934·5	0·00000	0·0
				3)2026990·7		3)416498·3
				675663·6		138832·8
$\frac{3}{8}$ × Angular Interval				·0524		·0524
				35404·77		7274·8
Longitudinal Interval				29·5		29·5
Moment of Wedges (uncorrected)				1044440·7		214606·6
Correction for Appendage				0·0		0·0
„ „ Layer				−7427·3		−611·7
				209156)1037013·4		209156)213994·9
BN = ...				4·958	B_1N = ..	1·023
BG sin. θ = 8·529 × ·4067 = ...				3·468	BG vers. θ = 8·529 × ·0865 .. =	·738
GZ = ...				1·49		·285
Displacement				5976		5976
Righting Moment in foot-tons				8904·2	Work in foot-tons	1703·2

INCLINED WATER SECTION.

Functions of Ordinates { Immersed ..	276·9
Functions of Ordinates { Emerged	234·8
	511·7
Longitudinal Interval	29·5
Total Area	15095·2

Functions of Squares of Ordinates { Immersed	6879·2
Functions of Squares of Ordinates { Emerged	5198·0
	2)1681·2
	840·6
	29·5
	15095·2)21797·7
C. G. of Area towards the Immersed side ..	1·64

CORRECTING LAYER.

Excess in Volume of the Immersed Wedge (found above)	4369·0

Thickness of Layer = 4369 ÷ 15095·2 = ·28 foot.

Correction for Statical Stability = 4369 × 1·7 = 7427·3.

Correction for Dynamical Stability = 4369 × ·14 = 611·7.

TABLE VII.—*Continued.*

CALCULATION FOR CURVE OF STABILITY.

No. 4.—COMBINATION TABLE.

CALCULATION OF STABILITY AT AN INCLINATION OF 32 DEGREES.

IMMERSED WEDGE.

Inclinations of Radial Planes.	Functions of Ordinates for Area of Inclined Water Section.	Functions of Squares of Ordinates.	Multipliers.	Functions of Squares of Ordinates for Volumes of Wedges.
Degrees.				
0	..	5316·6	1	5316·6
8	..	5650·5	4	22602·0
16	..	6078·2	2	12156·4
24	..	6879·2	4	27516·8
32	296·9	7835·9	1	7835·9
For Immersed Wedge				75427·7
For Emerged Wedge				62363·6
				2)13064·1
				6532·05
½ × Angular Interval				·0465
				303·7
Longitudinal Interval				29·5
Excess in Volume of the Immersed Wedge without the Appendage ..				8959·2

EMERGED WEDGE.

0	..	5316·6	1	
8	..	5203·6	4	57324·4
16	..	5200·7	2	
24	..	5198·0	4	
32	231·3	5039·2	1	5039·2
				62363·6

OUTLYING APPENDAGE.

RESULTS OBTAINED BY SEPARATE CALCULATIONS.

Volume	136·4 cub. ft.
Moment of Volume for Statical Stability	2318·8
Moment of Volume for Dynamical Stability	136·4
Area of Water Section	107·4
Moment of do.	1664·7

BOTH WEDGES.

Sums of Functions of Cubes of Ordinates.	Multipliers.	Products of Functions of Cubes.	Statical Stability. Cosines of Inclinations.	Statical Stability. Functions of Cubes for Moments of Wedges.	Dynamical Stability. Sines of Inclinations.	Dynamical Stability. Functions of Cubes for Moments of Wedges.
243056·8	1	243056·8	·84805	206124·3	·52992	128800·6
249699·9	4	998799·6	·91355	912453·4	·40674	406251·7
266234·5	2	532469·0	·96126	511841·1	·27564	146769·8
293934·5	4	1175738·0	·99027	1164298·1	·13917	163627·5
326457·9	1	326457·9	1·00000	326457·9	·00000	0·0
				3)3121174·8		3)845449·6
				1040391·6		281816·5
½ × Angular Interval				·04654		·04654
				48419·8		13115·7
Longitudinal Interval				29·5		29·5
Moment of Wedges (uncorrected)				1428384·1		386913·1
Correction for Appendage				2318·8		136·4
„ Layer				−24558·1		−2637·7
				209156)1406144·8		209156)384411·8
B N = ...				6·723	B$_1$N = ..	1·838
B G sin. θ = 8·529 × ·53 = ...				4·520	B G vers. θ = 8·529 × ·152 .. =	1·296
G Z = ...				2·203		·542
Displacement = ...				5976		5976
Righting Moment in foot-tons				13165·13	Work in foot-tons =	3239·

INCLINED WATER SECTION.

Functions of Ordinates	Immersed ..	296·9
	Emerged	231·3
		528·2
Longitudinal Interval		29·5
Area without Appendage ..		15581·9
Area of Appendage		107·4
Total Area		15689·3
Functions of Squares of Ordinates	Immersed	7835·9
	Emerged	5039·2
		2)2796·7
		1398·4
Longitudinal Interval		29·5
Moment without Appendage ..		41252·8
Moment of Appendage		1664·7
		15689·3)42917·5
C. G. of Area towards Immersed side = ..		2·73

CORRECTING LAYER.

Excess in Volume of the Immersed Wedge (found above) .. .. =	8959·2
Volume of Appendage	136·4
Total Volume of Layer	9095·6

Thickness of Layer = 9095·6 ÷ 15689·3 = ·58 foot.

Correction for Statical Stability = 9095·6 × 2·7 = 24558·1.

Correction for Dynamical Stability = 9095·6 × ·29 = 2637·7.

TABLE VIII.

TABLE OF PERIODS AND LENGTHS OF WAVES IN DEEP WATER, ARRANGED ACCORDING TO THEIR VELOCITIES IN KNOTS.

Velocity. Knots per Hour.	Velocity. Feet per Second.	Velocity. Statute Miles per Hour.	Periods. Seconds.	Equivalent Pendulum. Feet.	Length. Feet.	Velocity. Knots per Hour.	Velocity. Feet per Second.	Velocity. Statute Miles per Hour.	Periods. Seconds.	Equivalent Pendulum. Feet.	Length. Feet.
1	1·688	1·15	0·33	0·09	0·56	16	27·01	18·42	5·26	22·9	143·8
2	3·376	2·30	0·66	0·36	2·25	17	28·70	19·57	5·59	25·8	162·3
3	5·064	3·45	0·98	0·80	5·06	18	30·38	20·72	5·92	29·0	182·0
4	6·752	4·60	1·31	1·43	9·00	19	32·07	21·87	6·25	32·3	202·8
5	8·44	5·75	1·64	2·24	14·05	20	33·76	23·02	6·58	35·8	224·7
6	10·13	6·91	1·97	3·22	20·20	21	35·45	24·17	6·91	39·4	247·8
7	11·82	8·06	2·30	4·38	27·5	22	37·14	25·32	7·24	43·3	272·0
8	13·50	9·21	2·63	5·72	36·0	23	38·82	26·47	7·57	47·3	297·3
9	15·19	10·36	2·96	7·24	45·5	24	40·51	27·62	7·90	51·5	323·6
10	16·88	11·51	3·29	8·94	56·2	25	42·20	28·77	8·23	55·9	351·2
11	18·57	12·66	3·32	10·80	68·0	26	43·89	29·93	8·56	60·4	379·8
12	20·26	13·81	3·65	12·9	80·9	27	45·58	31·08	8·89	65·2	409·6
13	21·94	14·96	4·27	15·1	95·0	28	47·26	32·23	9·21	70·1	440·5
14	23·63	16·11	4·60	17·5	110·1	29	48·95	33·38	9·54	75·2	472·5
15	25·32	17·26	4·93	20·1	126·4	30	50·64	34·53	9·87	80·5	505·7

TABLE IX.

TABLE OF RESISTANCES OF MATERIALS TO STRETCHING AND TEARING BY A DIRECT PULL.

In Pounds Avoirdupois per Square Inch.

MATERIALS.	Tenacity or Resistance to Tearing.	Modulus of Elasticity, or Resistance to Stretching.
METALS.		
Brass, cast, ...	18,000	9,170,000
„ wire, ...	49,000	14,230,000
Copper, cast, ...	19,000	
„ sheet, ...	30,000	
„ bolts, ...	36,000	
„ wire, ...	60,000	17,000,000
Iron, cast, average, ...	16,500	17,000,000
„ wrought, plates, ..	51,000	
„ joints, double riveted, ..	35,700	
„ „ single riveted, ..	28,600	
„ bars and bolts, ...	60,000 to 70,000	29,000,000
„ hoop, best-best, ...	64,000	
„ wire, ...	70,000 to 100,000	25,300,000
„ wire ropes, ...	90,000	15,000,000
Steel bars, ...	100,000 to 130,000	29,000,000 to 42,000,000
Steel plates, average, ...	80,000	

MATERIALS.	Tenacity or Resistance to Tearing.	Modulus of Elasticity, or Resistance to Stretching.
TIMBER.		
Ash, ...	17,000	1,600,000
Cedar, ...	11,400	486,000
Elm, ...	14,000	700,000 to 1,340,000
Fir, Red Pine, ...	12,000 to 14,000	1,460,000 to 1,900,000
„ Spruce, ...	12,400	1,400,000 to 1,800,000
„ Larch, ...	9,000 to 10,000	900,000 to 1,360,000
Lignum Vitæ, ...	11,800	
Mahogany, ...	8,000 to 21,800	1,255,000
Oak, European, ...	10,000 to 19,800	1,200,000 to 1,750,000
„ American, ...	10,250	2,150,000
Teak, Indian, ...	15,000	2,400,000
„ African, ...	21,000	2,300,000

TABLE X.

SHIP'S NAME.	Centre of mast abaft the point where the rabbet of stem cuts the water-line, supposing the Ship's Length to be Unity.			Sail carried on each mast, supposing the total Area to be Unity.			Length of Ship between the Perpendiculars.	Breadth Exterior.	Ratio of Length to Breadth.	Draught (mean).	Trim by the Stern.	Displacement in Tons.	Area of Mid-Section in Square Feet.	Mean Co-efficient of Fineness of Water Lines.	Total Area of Sail in Square Feet.	Centre of Effort before the Centre of Gravity of Immersed Longitudinal Vertical Middle Line Plane.
	Fore-mast.	Main-mast.	Mizen-mast.	Fore-mast, including Jib.	Main-mast.	Mizen-mast.										
							Ft. In.	Ft. In.		Ft. In.	Ft. In.					Ft.
Mersey class ..	·143	·589	·860	·423	·373	·204	300 2	52 0	5·77	22 0	2 0	5493	890	·720	26587	13·1
Ariadne class ..	·143	·580	·860	·423	·373	·204	280 0	50 1	5·58	21 2	1 8	4480	792	·707	26587	11·7
Newcastle class ..	·135	·560	·840	·407	·383	·210	250 0	52 0	4·81	22 6	2 0	4020	835	·674	25750	13·1
Shannon class ..	·137	·562	·844	·407	·383	·210	237 0	50 1½	4·73	22 0	1 0	3773	775	·719	25750	10·0
Aurora	·130	·575	·840	·407	·383	·210	227 0	50 1	4·53	21 4½	0 9	3314	729	·701	25750	10·1
Imperieuse	·138	·575	·845	·407	·380	·210	214 3	50 0½	4·28	21 10½	1 9	3385	755	·731	25750	10·4
Pearl class	·183	·563	·853	·421	·365	·211	200 0	40 4	4·96	17 8	2 6	2057	531	·678	16251	8·6
Inconstant	·172	·560	·840	·411	·381	·208	337 0	50 3½	6·70	23 10½	3 6	5782	944	·635	26034	11·96

TABLE XI.

RESULTS OF TRIALS OF ELEVEN TYPICAL STEAMSHIPS OF THE ROYAL NAVY.

NAME.	Speed.	Length.	Breadth.	Draught.		Displacement.	Area of Mid. Sec.	Indicated Horse-Power.	Speed of Screw.	Slip per cent.	$\frac{S^3 \times M}{I.H.P.}$	$\frac{S^3 \times D^{\frac{2}{3}}}{I.H.P.}$	REMARKS.
				Forward.	Aft.								
	Knots.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Tons.	Sq. Ft.		Knots.				
Amazon	12·396	187 0	36 0	13 5½	16 5	1458	412	1664	12·800	3·16	471·7	147·2	Full Boiler Power.
Do.	10·894	187 0	36 0	13 5½	16 5	1458	412	1040	11·059	1·49	512·1	159·8	Half „ „
Bellerophon ..	14·227	300 0	56 0	18 10	24 9	6372	1065	5966	14·610	2·62	514·1	165·9	Full „ „
Do. ..	12·103	300 0	56 0	18 10	24 9	6372	1065	3119	12·275	1·40	605·3	195·3	Half „ „
Constance ..	12·301	253 11	53 0	17 1	20 9	2781	528	2020	13·590	9·49	486·5	182·2	Full „ „
Do. ..	10·575	253 11	53 0	17 1	20 9	2781	528	1178	11·410	7·32	530·1	198·5	Half „ „
Dwarf	10·525	155 0	25 0	7 7	8 5	551	172	608	14·977	29·73	330·0	129·0	Full „ „
Do.	8·712	155 0	25 0	7 7	8 5	551	172	330	12·289	29·11	344·9	134·8	Half „ „
Fairy	13·229	144 8	21 1½	4 11½	7 0½	205	85	406	15·967	17·15	484·3	198·1	Full „ „
Himalaya ..	12·928	340 5	46 1¾	19 8	21 4	4375	730	2338	16·268	20·53	674·7	247·2	Full „ „
Do. ..	11·473	340 5	46 1¾	19 8	21 4	4375	730	1645	14·364	20·13	670·1	245·6	Half „ „
Jumna	14·656	360 0	49 1½	17 8	21 10	2009	529	4894	13·774	Negative. 6·40	537·8	214·2	Full „ „
Do.	11·771	360 0	49 1½	17 8	21 10	2009	529	2466	11·054	Negative. 6·49	552·9	220·2	Half „ „
Meteor (Battery)	5·23	172 6	43 11	6 5	8 0	1338	308	498	8·36	37·44	88·5	34·9	Full „ „
Northumberland	15·459	400 0	59 3½	23 0	24 1	8778	1154	6621	13·953	Negative. 10·79	643·9	237·4	Full „ „
Do.	13·079	400 0	59 3½	23 0	24 1	8778	1154	3557	11·254	Negative. 16·22	725·8	267·6	Half „ „
Scorpion	10·515	224 6	42 4½	14 11	16 4	2660	604	1455	13·348	21·22	482·2	153·4	Full „ „
Warrior	14·079	380 0	58 0	25 9	27 8	9231	1263	5267	15·732	10·51	669·2	233·1	Full „ „

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